United States
Department of
Agriculture

Soil
Conservation
Service

In cooperation with
United States Department
of the Interior, Bureau of
Land Management;
United States Department
of Agriculture, Forest
Service; and Oregon
Agricultural Experiment
Station

Soil Survey of Jackson County Area, Oregon

How To Use This Soil Survey

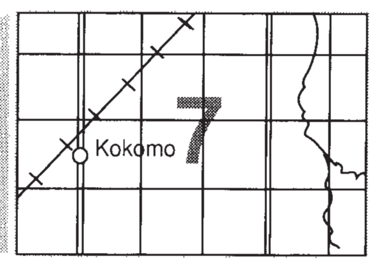
General Soil Map

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

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

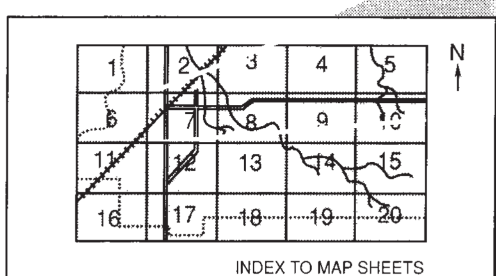
Detailed Soil Maps

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



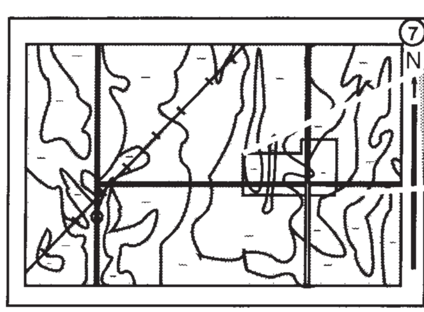
MAP SHEET

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

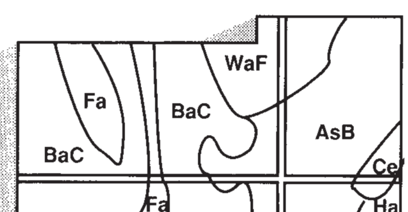


INDEX TO MAP SHEETS

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



MAP SHEET



AREA OF INTEREST

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

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

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in 1987. Soil names and descriptions were approved in 1989. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1987. This survey was made cooperatively by the Soil Conservation Service and Forest Service, the Bureau of Land Management, and the Oregon Agricultural Experiment Station. It is part of the technical assistance furnished to the Jackson County Soil and Water Conservation District and the Klamath County Soil and Water Conservation District.

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.

All programs of the Soil Conservation Service are offered on a nondiscriminatory basis, without regard to race, color, national origin, religion, sex, age, marital status, or handicap.

Cover: Typical area of Terrabella soils in the foreground and Freezener and Geppert soils in the center. Mt. McLoughlin is in the background.

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Septic tank absorption fields. Sewage lagoon areas. Trench sanitary landfill. Area sanitary landfill. Daily cover for landfill.

Construction materials (table 11) 594
Roadfill. Sand. Gravel. Topsoil.

Water management (table 12) 616
Limitations for—Pond reservoir areas; Embankments, dikes, and levees. Features affecting—Drainage, Irrigation, Terraces and diversions, Grassed waterways.

Engineering index properties (table 13) 632
Depth. USDA texture. Classification—Unified, AASHTO. Fragments greater than 3 inches. Percentage passing sieve number—4, 10, 40, 200. Liquid limit. Plasticity index.

Physical and chemical properties of the soils (table 14) 659
Depth. Clay. Moist bulk density. Permeability. Available water capacity. Soil reaction. Shrink-swell potential. Erosion factors. Organic matter.

Water features (table 15) 675
Hydrologic group. Flooding. High water table.

Soil features (table 16) 684
Bedrock. Cemented pan. Potential frost action. Risk of corrosion.

Classification of the soils (table 17) 693
Family or higher taxonomic class.

Foreword

This soil survey contains information that can be used in land-planning programs in the Jackson County Area. 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 the 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.

Jack P. Kanalz
State Conservationist
Soil Conservation Service

Soil Survey of
Jackson County Area, Oregon

By David R. Johnson, Soil Conservation Service

Fieldwork by David R. Johnson, Duane Setness, Russell A. Almaraz, Roger Borine, Laurel Fischer Mueller, and Roger Pfenninger, Soil Conservation Service

United States Department of Agriculture, Soil Conservation Service, in cooperation with
United States Department of the Interior, Bureau of Land Management; United States Department of Agriculture, Forest Service; and Oregon Agricultural Experiment Station

This survey area is in the southwestern part of Oregon (fig. 1). It consists of most of Jackson County and the southwestern part of Klamath County. It borders California to the south. Medford, the largest city in the survey area, is the county seat of Jackson County. Elevation ranges from 970 feet in an area where the Rogue River crosses into Josephine County to nearly 6,600 feet in an area on Hamaker Mountain, in Klamath County.

The total extent of the survey area is 1,585,308 acres. Of this total, 1,352,189 acres is in Jackson County and 233,119 acres is in Klamath County. About 1,042,308 acres is privately owned, and 543,000 acres is publicly owned. About 456,000 acres of the publicly owned land is managed by the Bureau of Land Management, 40,000 acres by the Forest Service, and 7,000 acres by other federal agencies. The remaining 40,000 acres is managed by the State of Oregon or by local governments.

The economy of the survey area is based mainly on forestry, agriculture, manufacturing, tourism, and cattle ranching. The favorable location of the area relative to major transportation corridors facilitates the growth of the economy.

The survey area has more than 110 different kinds of soil. The soils formed in a variety of parent materials. The soils in the Cascade Mountains formed in colluvium and residuum derived from andesite, basalt, tuff, breccia, volcanic ash, and pumice. Those in the Klamath Mountains formed in colluvium and residuum derived from granite, altered igneous and sedimentary rock, and scattered areas of ultramafic rock. The soils in the river valleys and on the adjacent foot slopes formed in alluvium derived from mixed sources.

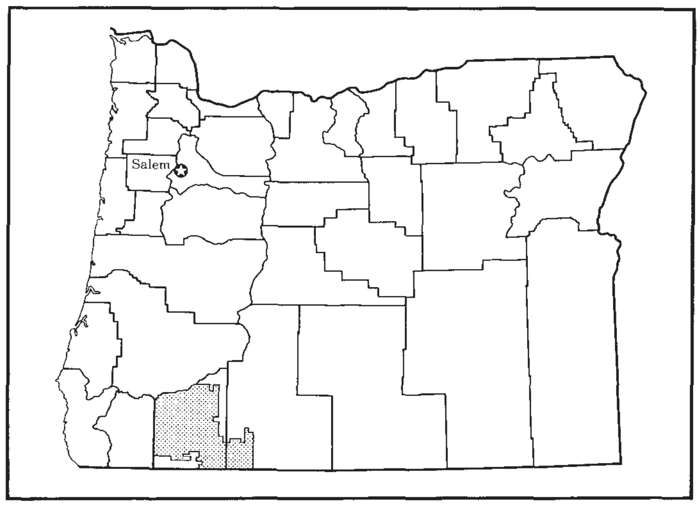

Figure 1.—Location of Jackson County Area in Oregon.

This survey updates soil surveys published in 1969, 1920, and 1913 *(25, 14, 22)*. It provides additional information.

General Nature of the Survey Area

This section gives general information about the survey area. It describes history and development; physiography, relief, and drainage; and climate.

History and Development

Several linguistically distinct Indian tribes inhabited the survey area before the immigration of non-Indian settlers *(8)*. The tribes included the Upland Takilma, the Shasta, the Dakubetede, and the Klamath. The Upland Takilma lived in the upper reaches of the valley of Bear Creek, in the valley of the Rogue River, and in the nearby mountains. The Shasta lived in the valley of Bear Creek, in the Ashland area. The Dakubetede lived in the valley of the Applegate River, near what is now the community of Ruch. The Klamath seasonally hunted and harvested edible plants in the High Cascades.

The Indians occupied semipermanent villages close to sources of food and other needs. They periodically burned some areas in order to increase the growth of edible plants, including huckleberry bushes and browse for big game *(5)*. In the 1850's, there were hostilities between the Indians and miners in the survey area. The armed conflicts drastically reduced the Indian population. Many of those who survived lived on the Table Rock Reservation before they were moved to reservations in the Willamette Valley.

In 1827, a party of trappers from the Hudson Bay Company entered the survey area. It explored the area while trapping animals along streams *(27)*. The early trappers opened up a route to California, which later became important during the gold rush. The route was near the present course of Interstate Highway 5.

After the discovery of placer gold near Jacksonville in 1852, many miners entered into the survey area. They were a culturally diverse group, as is revealed in such place names as China Gulch, Kanaka Flats, and Negro Ben Mountain. Mexican packers brought in food and other supplies from California *(27)*. Many Chinese were brought in to work the mines. Mineral resources continued to be important to the economy of the survey area well after the turn of the century.

Jackson County was established by an act of the Territorial Legislature in 1852. At that time the county included most of the counties that presently make up the southwestern part of Oregon. It was named after General Andrew Jackson. Jacksonville was the first county seat. In 1927, the county seat was moved to Medford.

The industry and population of the survey area expanded following the arrival of the railroad in 1883. By 1900, timber production had replaced mining as the main industry. The timber industry flourished as the means of shipping goods to distant markets improved.

The Klamath River was used to transport logs and lumber downstream. Pokegema, near the banks of the river, was one of the early logging towns established before the turn of the century. Travelers once considered this lumber boomtown the liveliest town between San Francisco and Portland *(6)*. The town suffered a major fire and was never rebuilt.

Hay, cereal crops, and tree fruit were the earliest commercial crops grown in the survey area. The population of Medford doubled between 1910 and 1915 as fruit growers arrived in response to nationwide advertising of the area as an ideal place for the production of tree fruit. The main agricultural products today are tree fruit, especially pears; hay and row crops; and dairy products, beef, and poultry.

The first effort to bring irrigation water to the survey area began in 1905, when the Fish Lake Water Company was established. Irrigation water currently is provided by a system of diversion canals developed by the Medford and Talent Irrigation Districts.

As farming, ranching, and timber harvesting continued, concerns about the use of the land and water resources became important. In response to these concerns, land owners organized the Jackson Soil and Water Conservation District in 1951 and the Rogue Soil and Water Conservation District in 1953. The present Jackson County Soil and Water Conservation District was formed in 1966 through the consolidation of both of these earlier districts.

Demands on the natural resources of the survey area have been intensified by an increase in population, which has more than doubled since the organization of the conservation district. This increase has created new problems of water quality, thereby increasing the complexity of water management and drainage issues.

Tourism is an important part of the economy in the survey area. The major outdoor recreational activities are visiting Crater Lake National Park, hiking the Pacific Crest Trail, river rafting, and fishing. In winter Mt. Ashland offers opportunities for skiing.

Physiography, Relief, and Drainage

The valleys of the Rogue River and Bear Creek, in the central part of the survey area, are characterized by moderate relief. They consist of flood plains, terraces, alluvial fans, and hills, which formed through erosion and the extensive deposition of alluvial outwash following the uplift of the surrounding mountains.

The major drainageways in the survey area are the Rogue, Applegate, and Klamath Rivers and Bear, Evans, Little Butte, Big Butte, Antelope, and Jenny Creeks. Some of these drainageways are in broad, fertile alluvial valleys. Others, such as the Klamath River and Jenny Creek, are entrenched in deeply incised canyons. Most of the streams in the survey area drain into the Rogue River and its tributary, the Applegate River. Most areas of the High Cascades, in the eastern part of the survey area, are drained by streams flowing generally south into the Klamath River.

East and north of the interior valleys are the Cascade Mountains, which are of volcanic origin. The western flank of the Cascade Mountains is the oldest part of this range. It has been deeply dissected by erosion. It gradually grades into the geologically younger High Cascades, which are characterized by broad plateaus and slopes of moderate relief that have been only slightly modified by erosion.

The Klamath Mountains, in the western part of the survey area, are steep and are characterized by strong relief. They are made up mainly of metamorphic and granitic rock. The metamorphic rock is highly folded and faulted. In many places the granitic rock has intruded into the metamorphic rock and occurs as scattered small bodies throughout the survey area. In areas south of Ashland and near West Evans Creek, in the northwestern part of the survey area, however, the granite occurs as bodies that are several square miles in size. Erosion has modified these geologically old mountains.

Climate

Prepared by the National Climatic Data Center, Asheville, North Carolina.

The climate of the survey area is tempered by wind from the Pacific Ocean. Summers are warm. Winters are cool, but snow and freezing temperatures are common only at the higher elevations. In summer rainfall is extremely light. As a result, crops require irrigation. Several weeks often pass without precipitation. Rains are frequent during the rest of the year, especially late in fall and in winter.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Medford, Prospect, and Ruch, Oregon, in the period 1951 to 1979. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter, the average temperature at Medford, Prospect, and Ruch is 39, 38, and 40 degrees F, respectively. The average daily minimum temperature is 31 degrees at Medford, 28 degrees at Prospect, and 30 degrees at Ruch. The lowest temperature on record, which occurred at Prospect on January 22, 1962, is -8 degrees. In summer, the average temperature is 70 degrees at Medford, 65 degrees at prospect, and 68 degrees at Ruch. The average daily maximum temperature is about 86 degrees. The highest recorded temperature, which occurred at Medford on August 8, 1978, is 110 degrees.

Growing degree days are shown in table 1. They 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 (40 degrees F). 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 total annual precipitation is about 20 inches at Medford, 42 inches at Prospect, and 27 inches at Ruch. Of these totals, 20 percent usually falls in April through September. The growing season for most crops usually falls within this period. The heaviest 1-day rainfall during the period of record was 4.39 inches at Prospect on December 22, 1964. Thunderstorms occur on about 9 days each year, and most occur in spring.

The average seasonal snowfall is about 10 inches at Medford, 70 inches at Prospect, and 22 inches at Ruch. The greatest snow depth at any one time during the period of record was 7 inches at Medford, 33 inches at Prospect, and 12 inches at Ruch. On the average, 2 days at Medford, 22 days at prospect, and 5 days at Ruch have at least 1 inch of snow on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 45 percent. Humidity is higher at night, and the average at dawn is about 85 percent. The sun shines 70 percent of the time in summer and 25 percent in winter. The prevailing wind is from the northwest. Average windspeed is highest, 6 miles per hour, in spring.

In most winters one or two storms bring strong and sometimes damaging winds. In some years the accompanying heavy rains cause serious flooding. Every few years the invasion of a large continental airmass from the east causes abnormal temperatures either in winter or in spring. In winter several consecutive days are well below freezing. In summer a week or more is sweltering.

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 biological activity.

The soils and miscellaneous areas in the survey area are in a 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 a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Individual soils on the landscape commonly merge gradually into 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 a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret 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 are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are 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 are 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 predict with a fairly high degree of accuracy 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.

The descriptions, names, and delineations of the soils in this survey area do not fully agree with those of the soils in adjacent survey areas. Differences are the result of a better knowledge of soils, modifications in series concepts, or variations in the intensity of mapping or in the extent of soils in the survey areas.

Survey Procedures

The general procedures followed in making this survey are described in the National Soils Handbook of the Soil Conservation Service. References that were used in the development of the survey were the "Interim Soil Survey Report, Jackson Area, Oregon," published in 1969 *(25)*; mapping of the geomorphic surfaces in the valleys of the Rogue River and Bear Creek by Parsons (unpublished); geologic maps of the Medford Quadrangle, published by the U.S. Geological Survey (USGS) in 1956 and 1982 *(30, 21)*; and the memorandum of understanding between the Soil Conservation Service and the Bureau of Land Management, the Oregon Agricultural Experiment Station, and the Forest Service.

Hillslopes and relief gradients generally were determined through examination of contour intervals on topographic maps. Cultural features and drainageways were recorded from field observations and through examination of USGS 7½- and 15-minute topographic maps.

The soils in the survey area were mapped according to predictable soil patterns that occur on landforms. The general soil-landform relationships are described in detail in the section "Formation of the Soils." Traverses and transects were used to confirm soil-landform models that were established for various parts of the survey area.

Traverses across the landscape were made so that soil scientists could determine the delineations of the map units and supplement and verify conclusions based on an examination of the tonal patterns on the aerial photographs used to predict the occurrence of different kinds of soil. The traverses were made by truck and on foot. The soil was examined when changes in characteristics were apparent. Where the soils vary considerably, many traverses were made at short intervals.

Transects were made randomly across areas of the map units so that the soil scientists could determine the composition of the dominant and included soils. The soil scientists generally crossed the areas on foot, following a course that had been charted on aerial photographs. The soil characteristics were examined and documented at regular intervals.

The survey area was mapped at two levels of intensity. A higher level was used in mapping alluvial soils and soils on low foothills, which are under intensive agricultural or community development. Maps of flood plains published by the Federal Emergency Management Agency were used as an aid in determining the boundaries of the flood plains. The minimum size of map unit delineations was 5 acres. About 20 percent of the survey area was mapped at this level.

A lower level of intensity was used in mapping gently sloping to steep soils on uplands. These soils formed in various kinds of parent material. They are used for timber production, livestock grazing, or wildlife habitat. The minimum size of the delineations was mainly about 40 acres, but the delineations are as small as 10 acres in areas that are considered to be of extreme importance. About 80 percent of the survey area was mapped at the lower level of intensity.

Spot symbols are used on the maps to identify contrasting kinds of soil and miscellaneous areas that are less than 5 acres in size. Under the heading "Detailed Soil Map Units," contrasting soils or miscellaneous areas that are included in mapping are described if they are of significant extent in a map unit.

The soil mapping in the valleys of the Rogue River and Bear Creek and in some adjacent areas is a revision of the mapping in the survey of the Jackson County area published in 1969 *(25)*. Since that time more has been learned about the soils through laboratory analyses and through examination of data on crop yields and timber site productivity. Previous concepts have been revised because of this improved understanding.

Samples for chemical and physical analyses were taken from typical pedons of the major soils in the survey area. The analyses were made by the Soil Survey Laboratory in Lincoln, Nebraska, and by the laboratory at Oregon State University. The results of the analyses were used in classifying the soils, in determining their fertility and erodibility, and in making various interpretations for engineering, agricultural, and other land uses.

Soil-plant relationships were evaluated in the development of the detailed map unit descriptions included in this survey. Foresters and range conservationists assisted in measuring the potential for timber production at representative forested sites. Soil and range conservationists assisted in collecting crop and forage yield data on farms and in areas of rangeland and in determining the potential productivity of the soils. The data were then correlated with the kind of soil and the site characteristics of the map units. The results were used to predict the performance of the various map units in the survey area.

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, it 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 another 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 for broad interpretive purposes. Each of the broad groups and the map units in each group are described on the following pages.

Map Unit Descriptions

Soils Formed in Alluvium on Flood Plains, Stream Terraces, and Alluvial Fans

These soils make up about 6 percent of the survey area.

1. Ruch-Medford-Camas

Very deep, well drained, moderately well drained, and excessively drained soils that have a surface layer of gravelly silt loam, silty clay loam, or sandy loam

This map unit is on the flood plains, stream terraces, and alluvial fans along the Applegate River, Bear Creek, the Rogue River, and their tributaries. The vegetation in areas that have not been cultivated is mainly hardwoods or hardwoods and conifers and an understory of grasses, shrubs, and forbs. Slopes generally are 0 to 20 percent. Elevation is 1,000 to 4,000 feet. The mean annual precipitation is about 18 to 40 inches, the mean annual temperature is 50 to 54 degrees F, and the average frost-free period is 125 to 180 days.

This unit makes up about 6 percent of the survey area. It is about 25 percent Ruch soils, 20 percent Medford soils, and 10 percent Camas soils (fig. 2). The remaining 45 percent is Barron, Central Point, Newberg, Evans, Foehlin, Kerby, Shefflein, Takilma, Abin, Coleman, Clawson, Kubli, Cove, and Gregory soils and Dumps and Riverwash. Abin, Cove, Evans, and Newberg soils and Riverwash are on flood plains. Central Point, Coleman, Foehlin, Gregory, Kerby, Kubli, and Takilma soils are on stream terraces. Barron, Clawson, and Shefflein soils are on alluvial fans. They formed in material derived from granitic rock. Dumps are in areas that have been mined.

Ruch soils are on alluvial fans and are well drained. The surface layer is gravelly silt loam. The subsoil is loam.

Medford soils are on stream terraces and are moderately well drained. The surface layer is silty clay loam. The subsoil is silty clay, silty clay loam, and clay loam. The substratum is sandy clay loam.

Camas soils are on flood plains and are excessively drained. The surface layer is sandy loam. The substratum is very gravelly loamy sand and extremely gravelly coarse sand. These soils are frequently flooded.

This unit is used mainly for cultivated crops, hay and pasture, tree fruit, or homesite development. A few areas are used for timber production or wildlife habitat.

This unit is well suited to crops. The main limitations affecting crop production are permeability, wetness in winter and spring, flooding, and seasonal droughtiness. In summer, irrigation is needed for the maximum production of most crops. Sprinkler and trickle irrigation systems are the best methods of applying water, particularly on the sloping parts of the landscape and on soils that have a rapid water intake rate. Unless protected, the Camas soils are poorly suited to crops, hay and pasture, and tree fruit because of the risk of

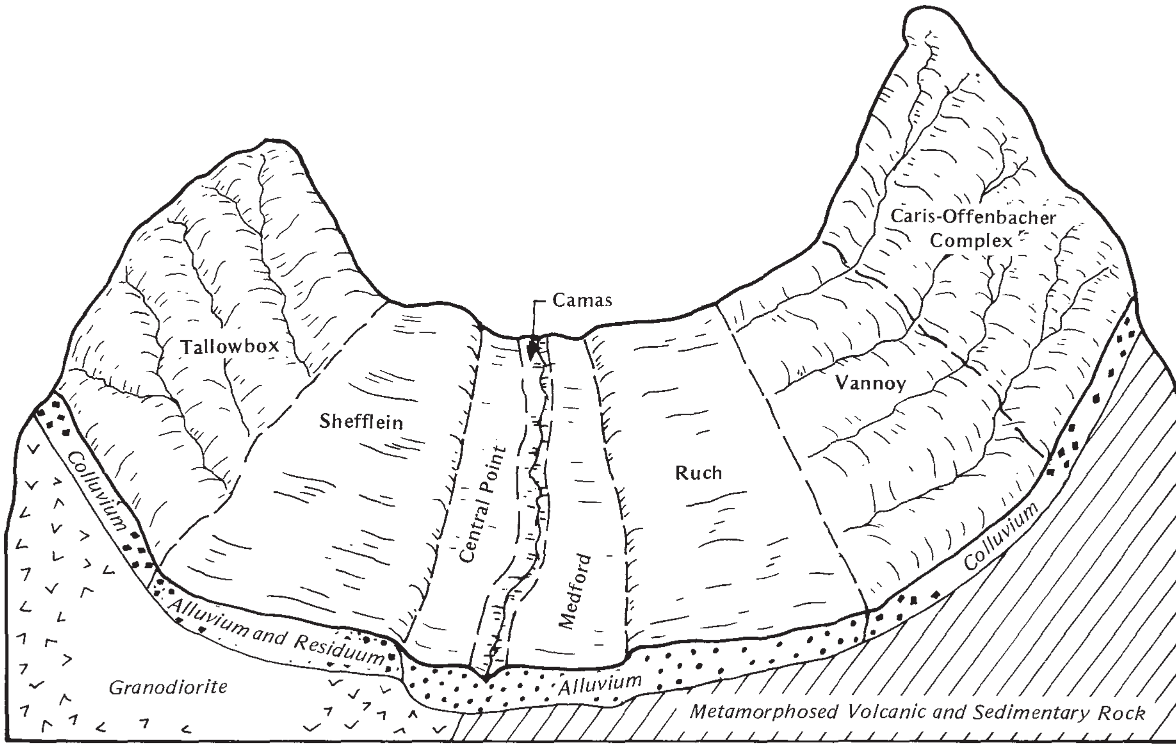

Figure 2.—Typical pattern of soils in the Ruch-Medford-Camas, Tallowbox-Shefflein, and Vannoy-Caris-Offenbacher general map units.

flooding. A subsurface drainage system can lower the water table in the Medford soils if suitable outlets are available.

The main limitations affecting homesite development are moderately slow permeability, wetness, and the shrink-swell potential in areas of the Medford soils and the hazard of flooding and very rapid permeability in areas of the Camas soils. The Ruch soils have few limitations.

Soils Formed in Material Weathered From Sedimentary and Igneous Rock and Mixed Alluvium on Fan Terraces, Ridges, Knolls, Hillslopes, and Alluvial Fans

These soils make up about 10 percent of the survey area.

2. Agate-Winlo-Provig

Well drained and somewhat poorly drained soils that are moderately deep or shallow to a hardpan or are very deep and that have a surface layer of loam, very gravelly clay loam, or very gravelly loam; on fan terraces

This map unit is on fan terraces in the valley of the Rogue River. The native vegetation on the Agate soils is mainly grasses, forbs, and shrubs. That on the Winlo soils is mainly grasses, sedges, rushes, and forbs. That on the Provig soils is mainly hardwoods and an understory of grasses, shrubs, and forbs. Slopes generally are 0 to 15 percent but range to 35 percent. Elevation is 1,100 to 1,850 feet. The mean annual precipitation is about 18 to 30 inches, the mean annual temperature is 52 to 54 degrees F, and the average frost-free period is 150 to 180 days.

This unit makes up about 2 percent of the survey area. It is about 45 percent Agate soils, 25 percent Winlo soils, and 10 percent Provig soils. The remaining 20 percent is Brader and Debenger soils on low knolls; Abin, Medford, and Cove soils in drainageways; Coker and Padigan soils on concave slopes; and Carney soils.

Agate, Winlo, and Provig soils formed in poorly sorted, gravelly old stream alluvium.

Agate soils are moderately deep to a hardpan and are well drained. The surface layer is loam. The subsoil is clay loam over a hardpan. The substratum is extremely gravelly coarse sandy loam.

Winlo soils are shallow to a hardpan and are somewhat poorly drained. The surface layer is very gravelly clay loam. The subsoil is very gravelly clay over a hardpan. The substratum is extremely gravelly coarse sandy loam.

Provig soils are very deep and well drained. The surface layer is very gravelly loam. The subsoil is very gravelly clay loam. The substratum is extremely gravelly clay, extremely gravelly clay loam, and extremely gravelly sandy loam.

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

The main limitations in the areas used for hay and pasture or for livestock grazing are wetness in winter and spring, droughtiness in summer and fall, compaction, the depth to a hardpan in the Agate and Winlo soils, and the very gravelly surface layer in the Winlo and Provig soils. The Winlo soils remain wet for long periods in spring. If possible, grazing should be delayed until the soils are firm enough to withstand trampling by livestock. The use of ground equipment is limited in many areas by gravel and cobbles on the surface of the Winlo soils. In summer, irrigation is needed for maximum forage production. Because of the hardpan, overirrigation can result in a perched water table.

The main limitations affecting homesite development are wetness, the depth to a hardpan, slow permeability, and a high shrink-swell potential. The slope also is a major limitation in some areas. These soils are poorly suited to standard systems of onsite waste disposal because of wetness and the depth to a hardpan in the Winlo soils, the depth to a hardpan in the Agate soils, and slow permeability of the Provig soils.

3. Brader-Debenger-Langellain

Shallow and moderately deep, well drained and moderately well drained soils that have a surface layer of loam; on ridges and knolls

The native vegetation on this map unit is mainly hardwoods and some conifers and an understory of grasses, shrubs, and forbs. Slopes generally are 1 to 40 percent. Elevation is 1,000 to 3,500 feet. The mean annual precipitation is about 18 to 40 inches, the mean annual temperature is 48 to 54 degrees F, and the average frost-free period is 130 to 180 days.

This unit makes up about 2 percent of the survey area. It is about 35 percent Brader soils, 20 percent Debenger soils, and 15 percent Langellain soils. The remaining 30 percent is Shefflein soils on alluvial fans; Kerby, Medford, and Gregory soils on stream terraces; and Carney, Selmac, and Coker soils on concave slopes.

Brader and Debenger soils formed in colluvium derived from sedimentary rock. Langellain soils formed in colluvium and alluvium derived from sedimentary rock.

Brader soils are shallow and well drained. The surface layer and subsoil are loam.

Debenger soils are moderately deep and well drained. The surface layer is loam. The subsoil is clay loam.

Langellain soils are moderately deep and moderately well drained. The surface layer is loam. The subsoil is clay.

This unit is used mainly for hay and pasture or for livestock grazing. A few areas are used for homesite development or wildlife habitat.

The main limitations in the areas used for hay and pasture or for livestock grazing are wetness in winter and spring, the depth to bedrock, restricted permeability, droughtiness, and compaction. The slope also is a major limitation in some areas. The Langellain soils remain wet for long periods in spring. Grazing should be delayed until the soils are firm enough to withstand trampling by livestock. In summer, irrigation is needed for maximum forage production. Because of the layer of clay in the Langellain soils and the depth to bedrock in the Brader soils, overirrigation can result in a perched water table.

The main limitations affecting homesite development are wetness, a high shrink-swell potential, and the depth to bedrock. The slope also is a major limitation in some areas.

4. Carney-Coker

Moderately deep and very deep, moderately well drained and somewhat poorly drained soils that have a surface layer of clay or cobbly clay; on alluvial fans and hillslopes

The native vegetation on the Carney soils in this map unit is mainly scattered hardwoods and an understory of grasses, shrubs, and forbs. That on the Coker soils is mainly grasses, sedges, and forbs. Slopes generally are 0 to 35 percent. Elevation is 1,200 to 4,000 feet. The mean annual precipitation is about 18 to 35 inches, the mean annual temperature is 45 to 54 degrees F, and the average frost-free period is 120 to 180 days.

This unit makes up about 6 percent of the survey area. It is about 55 percent Carney soils and 10 percent Coker soils. The remaining 35 percent is Brader and Debenger soils on knolls; Heppsie and McMullin soils on hillslopes; Padigan and Phoenix soils on concave slopes; Cove soils in drainageways; and Darow, Medco, and Tablerock soils.

Carney soils formed in alluvium and colluvium derived from igneous rock. Coker soils formed in clayey alluvium derived from igneous rock.

Carney soils are moderately deep and moderately well drained. The surface layer is clay or cobbly clay. The subsoil is clay.

Coker soils are very deep and somewhat poorly drained. The surface layer and subsoil are clay.

This unit is used mainly for tree fruit, hay and pasture, homesite development, livestock grazing, or wildlife habitat.

The main limitations in the areas used for hay and pasture or for tree fruit are the high content of clay, a slow rate of water intake, wetness in winter and spring, droughtiness in summer and fall, and the slope. The Coker soils remain wet for long periods in spring. Grazing should be delayed until the soils are firm enough to withstand trampling by livestock. In summer, irrigation is needed for the maximum production of forage crops and tree fruit. Because of very slow permeability, water applications should be regulated so that the water does not stand on the surface and damage the crops. Because of the slope in some areas, sprinkler and trickle irrigation systems are the best methods of applying water. The high content of clay severely limits tillage. The soils are well suited to permanent pasture.

The main limitations affecting homesite development are very slow permeability, a high shrink-swell potential, the depth to bedrock, low strength, and wetness. The slope also is a major limitation in some areas. These soils are poorly suited to standard systems of onsite waste disposal because of the very slow permeability and depth to bedrock in the Carney soils and the very slow permeability and wetness in the Coker soils. Properly designing the foundations and footings of buildings helps to prevent the structural damage caused by shrinking and swelling.

The more sloping areas of this unit are used for livestock grazing. The main limitations affecting livestock grazing are compaction, erosion, droughtiness, and the slope.

Soils Formed in Material Weathered From Granodiorite on Alluvial Fans, Ridges, and Hillslopes.

These soils make up about 5 percent of the survey area.

5. Tallowbox-Shefflein

Moderately deep and deep, somewhat excessively drained and well drained soils that have a surface layer of gravelly sandy loam or loam and receive 25 to 40 inches of annual precipitation

This map unit is on hillslopes, ridges, and alluvial fans. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs. Slopes generally are 2 to 70 percent. Elevation is 1,000 to 4,000 feet. The mean annual precipitation is about 25 to 40 inches, the mean annual temperature is 46 to 54 degrees F, and the average frost-free period is 100 to 160 days.

This unit makes up about 3 percent of the survey area. It is about 55 percent Tallowbox soils and 30 percent Shefflein soils (fig. 2). The remaining 15 percent is Barron soils on alluvial fans, Clawson soils on concave slopes, and Rogue soils at elevations of more than 4,000 feet.

Tallowbox soils are moderately deep and somewhat excessively drained. The surface layer and subsoil are gravelly sandy loam.

Shefflein soils are deep and well drained. The surface layer is loam. The subsoil is clay loam and sandy clay loam.

This unit is used mainly for timber production or wildlife habitat. A few of the more gently sloping areas of the Shefflein soils are used for hay and pasture or for homesite development.

The main limitations affecting timber production are erosion, compaction, plant competition, and the slope. Seedling mortality also is a major management concern, particularly on south-facing slopes. Management that minimizes erosion is essential when timber is harvested. Site preparation is needed to ensure adequate reforestation. High-lead or other cable logging systems should be used on the steeper slopes.

Irrigation is needed in the areas used for hay and pasture. Sprinkler irrigation is the best method of applying water. This method helps to prevent excessive runoff and minimizes the risk of erosion.

The Shefflein soils are well suited to homesite development. The main limitation is moderately slow permeability.

6. Wolfpeak-Tethrick-Siskiyou

Very deep and moderately deep, well drained and somewhat excessively drained soils that have a surface layer of sandy loam or gravelly sandy loam and receive 40 to 50 inches of annual precipitation

This map unit is on hillslopes, ridges, and old slump benches. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs. Slopes generally are 3 to 75 percent. Elevation is 1,200 to 4,000 feet. The mean annual precipitation is about 40 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days.

This unit makes up about 1 percent of the survey area. It is about 25 percent Wolfpeak soils, 25 percent Tethrick soils, and 25 percent Siskiyou soils. The remaining 25 percent is Beekman and Colestine soils on steep hillslopes; Josephine and Pollard soils on gently sloping hillslopes and on concave slopes; and Goolaway, Musty, and Speaker soils.

Wolfpeak soils are very deep and well drained. The surface layer is sandy loam. The subsoil is clay loam.

Tethrick soils are very deep and well drained. The surface layer, subsoil, and substratum are sandy loam.

Siskiyou soils are moderately deep and somewhat excessively drained. The surface layer is gravelly sandy loam. The subsoil and substratum are sandy loam.

This unit is used mainly for timber production or wildlife habitat. A few of the more gently sloping areas of the Wolfpeak soils are used for hay and pasture or for homesite development.

The main limitations affecting timber production are erosion, compaction, plant competition, and the slope. Seedling mortality also is a major management concern, particularly on south-facing slopes. Management that minimizes erosion is essential when timber is harvested. Site preparation is needed to ensure adequate reforestation. High-lead or other cable logging systems should be used on the steeper slopes.

Irrigation is needed in the areas used for hay and pasture. Sprinkler irrigation is the best method of applying water. This method helps to prevent excessive runoff and minimizes the risk of erosion.

The Wolfpeak soils are well suited to homesite development. The main limitation is moderately slow permeability.

7. Steinmetz-Lettia

Very deep and deep, somewhat excessively drained and well drained soils that have a surface layer of sandy loam and receive 45 to 60 inches of precipitation

This map unit is on hillslopes and old slump benches. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs. Slopes generally are 12 to 75 percent. Elevation is 1,800 to 4,000 feet. The mean annual precipitation is about 45 to 60 inches, the mean annual temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 160 days.

This unit makes up about 1 percent of the survey area. It is about 50 percent Steinmetz soils and 25 percent Lettia soils (fig. 3). The remaining 25 percent is Acker and Dumont soils on gently sloping hillslopes and on concave slopes; Atring and Kanid soils on steep hillslopes; Dubakella, Gravecreek, and Pearsoll soils, which formed in material derived from serpentinitic rock; Goolaway, Musty, and Norling soils; and Rogue soils at elevations of more than 4,000 feet.

Steinmetz soils are very deep and somewhat excessively drained. The surface layer and subsoil are sandy loam.

Lettia soils are deep and well drained. The surface layer is sandy loam. The subsoil is clay loam and loam. The substratum is loam.

This unit is used mainly for timber production or wildlife habitat. The main limitations affecting timber production are erosion, compaction, plant competition, and the slope. Seedling mortality also is a major management concern, particularly on south-facing slopes. Management that minimizes erosion is essential when timber is harvested. Site preparation is needed to ensure adequate reforestation. High-lead or other cable logging systems should be used on the steeper slopes.

Soils Formed in Material Weathered From Igneous Rock on Plateaus and Hillslopes

These soils make up about 40 percent of the survey area.

8. Freezener-Geppert

Very deep and moderately deep, well drained soils that have a surface layer of gravelly loam or very cobbly loam

This map unit is on plateaus and hillslopes. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs. Slopes generally are 1 to 70 percent. Elevation is 1,500 to 4,000 feet. The mean annual precipitation is about 30 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days.

This unit makes up about 5 percent of the survey area. It is about 65 percent Freezener soils and 30 percent Geppert soils. The remaining 5 percent is McMullin soils on ridges and steep hillslopes and Terrabella soils on concave slopes and near drainageways.

Freezener soils are very deep. The surface layer is gravelly loam. The subsoil is clay loam and clay.

Geppert soils are moderately deep. The surface layer is very cobbly loam. The subsoil is extremely cobbly clay loam.

This unit is used mainly for timber production, livestock grazing, or wildlife habitat. A few areas are used for hay and pasture.

The main limitations affecting timber production are erosion, compaction, plant competition, and the slope. Seedling mortality also is a major management concern, particularly on south-facing slopes. Site preparation is needed to ensure adequate reforestation. The large number of rock fragments in the Geppert soils increases the seedling mortality rate. High-lead or other cable logging systems should be used on the steeper slopes.

The main limitations affecting livestock grazing are compaction, erosion, and the slope. The slope limits access by livestock in some areas.

9. Straight-Freezener-Shippa

Moderately deep, very deep, and shallow, well drained soils that have a surface layer of extremely gravelly loam or gravelly loam

This map unit is on hillslopes and plateaus. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs. Slopes generally are 1 to 70 percent. Elevation is 2,000 to 4,000 feet. The mean annual precipitation is about 35 to 55 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days.

This unit makes up about 4 percent of the survey area. It is about 30 percent Straight soils, 25 percent Freezener soils, and 10 percent Shippa soils. The remaining 35 percent is McMullin soils on ridges and steep hillslopes, Takilma soils in drainageways, Geppert and McNull soils, Medco soils on gently sloping hillslopes and on concave slopes, and Terrabella soils on concave slopes and near drainageways.

Straight soils are moderately deep. The surface layer is extremely gravelly loam. The subsoil is very gravelly loam and very cobbly clay loam.

Freezener soils are very deep. The surface layer is gravelly loam. The subsoil is clay loam and clay.

Shippa soils are shallow. The surface layer is extremely gravelly loam. The subsoil is extremely cobbly loam.

This unit is used mainly for timber production, livestock grazing, or wildlife habitat.

The main limitations affecting timber production are erosion, compaction, plant competition, the slope, and the depth to bedrock in the Shippa soils. Seedling mortality also is a major management concern, particularly on south-facing slopes. Site preparation is needed to ensure optimum reforestation. The large number of rock fragments in the soils and the depth to bedrock in the Shippa soils increase the seedling

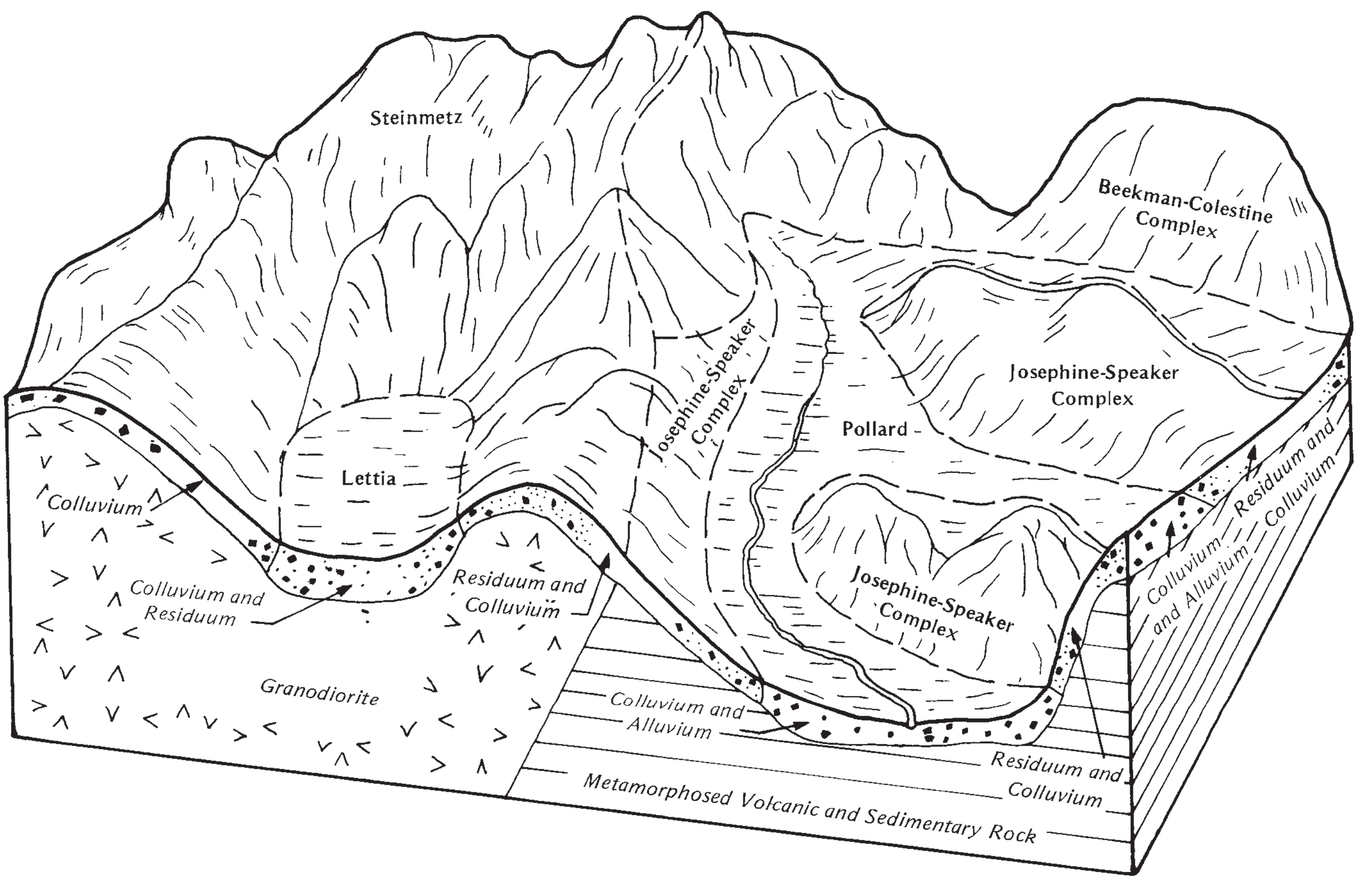

Figure 3.—Typical pattern of soils in the Steinmetz-Lettia and Josephine-Beekman-Speaker general map units.

mortality rate. High-lead or other cable logging systems should be used on the steeper slopes. Windthrow is a hazard on the Shippa soils because of the limited depth to bedrock, which restricts the rooting depth.

The main limitations affecting livestock grazing are compaction, erosion, and the slope. The slope limits access by livestock in some areas.

10. Dumont-Coyata

Very deep and moderately deep, well drained soils that have a surface layer of gravelly loam

This map unit is on plateaus and hillslopes. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs. Slopes generally are 1 to 80 percent. Elevation is 2,000 to 4,000 feet. The mean annual precipitation is about 40 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days.

This unit makes up about 3 percent of the survey area. It is about 40 percent Dumont soils and 30 percent Coyata soils. The remaining 30 percent is Reinecke soils on nearly level plateaus, Donegan and Killet soils at elevations of more than 4,000 feet, and Sibannac and Terrabella soils on concave slopes and near drainageways.

Dumont soils are very deep. The surface layer is gravelly loam. The subsoil is clay.

Coyata soils are moderately deep. The surface layer is gravelly loam. The subsoil is very cobbly and extremely cobbly clay loam.

This unit is used mainly for timber production, livestock grazing, or wildlife habitat.

The main limitations affecting timber production are erosion, compaction, plant competition, and the slope. Seedling mortality also is a major management concern, particularly on south-facing slopes. Site preparation is needed to ensure adequate reforestation. The large number of rock fragments in the Coyata soils increases the seedling mortality rate. High-lead or other cable logging systems should be used on the steeper slopes.

The main limitations affecting livestock grazing are compaction, erosion, and the slope. The slope limits access by livestock in some areas.

11. Medco-McMullin

Moderately deep and shallow, moderately well drained and well drained soils that have a surface layer of cobbly clay loam or gravelly loam

This map unit is on hillslopes. The native vegetation on the Medco soils is mainly hardwoods, a few scattered conifers, and an understory of grasses, shrubs, and forbs. That on the McMullin soils is mainly grasses, shrubs, and forbs. Slopes generally are 3 to 60 percent. Elevation is 1,500 to 4,000 feet. The mean annual precipitation is about 20 to 35 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days.

This unit makes up about 8 percent of the survey area. It is about 40 percent Medco soils and 35 percent McMullin soils. The remaining 25 percent is Heppsie soils on steep hillslopes, McNull and Carney soils, Coker soils on concave slopes, and Rock outcrop.

Medco soils are moderately deep and moderately well drained. The surface layer is cobbly clay loam. The subsoil is clay.

McMullin soils are shallow and well drained. The surface layer is gravelly loam. The subsoil is gravelly clay loam.

This unit is used mainly for livestock grazing or wildlife habitat. A few of the more gently sloping areas of the Medco soils are used for hay and pasture. A few areas of the Medco soils that receive enough precipitation are used for timber production.

The main limitations affecting livestock grazing are compaction, erosion, the depth to bedrock, droughtiness, seasonal wetness, the Rock outcrop, stones and cobbles on the surface, and the slope. The use of ground equipment generally is not practical on the McMullin soils because of the stones on the surface, the Rock outcrop, and the slope. The Rock outcrop and the slope also limit access by livestock in some areas. The Medco soils remain wet for long periods in spring. Grazing should be delayed until the soils are firm enough to withstand trampling by livestock.

The main limitations in the areas used for hay and pasture are wetness in winter and spring, droughtiness in summer and fall, and very slow permeability in the subsoil. In summer, irrigation is needed for maximum forage production.

The main limitations affecting timber production are erosion, compaction, slumping, seasonal wetness, and plant competition. Seedling mortality also is a major management concern, particularly on south-facing slopes.

12. Skookum-McMullin-Rock outcrop

Rock outcrop and moderately deep and shallow, well drained soils that have a surface layer of very cobbly loam or gravelly loam

This map unit is on hillslopes and plateaus. The native vegetation on the Skookum soils is mainly hardwoods, scattered conifers, and an understory of grasses, shrubs, and forbs. That on the McMullin soils is mainly grasses, shrubs, and forbs. Slopes generally are 1 to 70 percent. Elevation is 2,800 to 4,800 feet. The mean annual precipitation is about 18 to 35 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 150 days.

This unit makes up about 1 percent of the survey area. It is about 35 percent Skookum soils, 20 percent McMullin soils, and 20 percent Rock outcrop. The remaining 25 percent is Bogus soils on forested, north-facing slopes; Shoat soils on mounds in areas of patterned ground; Randcore soils between the mounds in areas of patterned ground; Carney soils on concave slopes; and Heppsie and Lorella soils.

Skookum soils are moderately deep. The surface layer is very cobbly loam. The subsoil is very cobbly clay loam, very cobbly clay, and extremely cobbly clay.

McMullin soils are shallow. The surface layer is gravelly loam. The subsoil is gravelly clay loam.

Rock outcrop consists of areas of exposed bedrock.

This unit is used mainly for livestock grazing or wildlife habitat. The main limitations affecting livestock grazing are compaction, erosion, the Rock outcrop, cobbles and stones on the surface, droughtiness, the depth to bedrock, and the slope. The use of ground equipment is not practical because of the cobbles and stones on the surface, the Rock outcrop, and the slope. The Rock outcrop and the slope also limit access by livestock in some areas. The suitability of this unit for range seeding is limited by the depth to bedrock in the McMullin soils, droughtiness, and the Rock outcrop.

13. McNull-McMullin-Medco

Moderately deep and shallow, well drained and moderately well drained soils that have a surface layer of loam, gravelly loam, or cobbly clay loam

The map unit is on hillslopes. The native vegetation on the McNull and Medco soils is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs. That on the McMullin soils is mainly grasses, shrubs, and forbs. Slopes generally are 12 to 60 percent. Elevation is 1,500 to 4,000 feet. The mean annual precipitation is about 25 to 40 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days.

This unit makes up about 8 percent of the survey area. It is about 45 percent McNull soils, 20 percent McMullin soils, and 20 percent Medco soils. The remaining 15 percent is Coker soils on concave slopes, Carney soils, and Rock outcrop.

McNull soils are moderately deep and well drained. The surface layer is loam. The subsoil is clay loam and cobbly clay.

McMullin soils are shallow and well drained. The surface layer is gravelly loam. The subsoil is gravelly clay loam.

Medco soils are moderately deep and moderately well drained. The surface layer is cobbly clay loam. The subsoil is clay.

This unit is used mainly for timber production, livestock grazing, or wildlife habitat. The McNull and Medco soils are used mainly for timber production or livestock grazing. The McMullin soils are used for livestock grazing.

The main limitations affecting timber production are erosion, compaction, slumping, plant competition, seasonal wetness, and the slope. Seedling mortality also is a major management concern, particularly on south-facing slopes. Site preparation is needed to ensure adequate reforestation. The Medco soils are subject to slumping. Road failure and landslides are likely to occur after road construction or clearcutting. The seasonal water table in the Medco soils restricts the use of equipment. High-lead or other cable logging systems should be used on the steeper slopes.

The main limitations affecting livestock grazing are compaction, erosion, the depth to bedrock, droughtiness, the Rock outcrop, stones and cobbles on the surface, seasonal wetness, and the slope. The use of ground equipment generally is not practical on the McMullin soils because of the stones on the surface, the Rock outcrop, and the slope. The Rock outcrop and the slope also limit access by livestock in some areas. The Medco soils remain wet for long periods in spring. Grazing should be delayed until the soils are firm enough to withstand trampling by livestock.

14. Tatouche-Bybee

Very deep, well drained and somewhat poorly drained soils that have a surface layer of gravelly loam or loam

This map unit is on hillslopes and plateaus. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs. Slopes generally are 1 to 65 percent. Elevation is 3,600 to 5,500 feet. The mean annual precipitation is about 30 to 50 inches, the mean annual temperature is 40 to 45 degrees F, and the average frost-free period is less than 100 days.

This unit makes up about 3 percent of the survey area. It is about 45 percent Tatouche soils and 30 percent Bybee soils. The remaining 25 percent is Farva, Hobit, and Pinehurst soils; Woodseye soils on ridges and convex slopes; Kanutchan and Sibannac soils on concave slopes and near drainageways; and Rock outcrop.

Tatouche soils are well drained. The surface layer is gravelly loam. The subsoil is gravelly clay loam and clay.

Bybee soils are somewhat poorly drained. The surface layer is loam. The subsoil and substratum are clay.

This unit is used mainly for timber production, livestock grazing, or wildlife habitat.

The main limitations affecting timber production are erosion, compaction, slumping, plant competition, seasonal wetness, and the slope. Seedling mortality also is a major management concern, particularly on south-facing slopes and in areas where air drainage is restricted. Site preparation is needed to ensure adequate reforestation. Air drainage is restricted in some areas. Proper timber harvesting methods can reduce the effects of frost on regeneration. The Bybee soils are subject to slumping. Road failure and landslides are likely to occur on these soils after road construction or clearcutting. The seasonal high water table in the Bybee soils restricts the use of equipment. High-lead or other cable logging systems should be used on the steeper slopes.

The main limitations affecting livestock grazing are compaction, erosion, and the slope. The slope limits access by livestock in some areas.

15. Oatman-Otwin

Very deep and moderately deep, well drained soils that have a surface layer of cobbly loam or stony sandy loam

This map unit is on plateaus and hillslopes. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs. Slopes generally are 0 to 65 percent. Elevation is 4,800 to 6,600 feet. The mean annual precipitation is about 30 to 40 inches, the mean annual temperature is 40 to 44 degrees F, and the average frost-free period is less than 100 days.

This unit makes up about 2 percent of the survey area. It is about 75 percent Oatman soils and 10 percent Otwin soils. The remaining 15 percent is Hoxie and Klamath soils on concave slopes and near drainageways.

Oatman soils are very deep. The surface layer is cobbly loam. The subsoil and substratum are very cobbly sandy loam.

Otwin soils are moderately deep. The surface layer is stony sandy loam. The subsoil is very cobbly sandy loam.

This unit is used mainly for timber production, livestock grazing, or wildlife habitat.

The main limitations affecting timber production are erosion, compaction, plant competition, and the slope. Seedling mortality also is a major management concern, particularly on south-facing slopes and in areas where air drainage is restricted. Site preparation is needed to ensure adequate reforestation. The large number of rock fragments in the soils increases the seedling mortality rate. Air drainage is restricted in some areas. Proper timber harvesting methods can reduce the effects of frost on regeneration. High-lead or other cable logging systems should be used on the steeper slopes.

The main limitations affecting livestock grazing are compaction, erosion, and the slope. The slope limits access by livestock in some areas.

16. Rustlerpeak-Farva

Moderately deep, well drained soils that have a surface layer of gravelly loam or very cobbly loam

This map unit is on plateaus and hillslopes. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs. Slopes generally are 3 to 70 percent. Elevation is 3,600 to 6,100 feet. The mean annual precipitation is about 40 to 55 inches, the mean annual temperature is 40 to 45 degrees F, and the average frost-free period is less than 100 days.

This unit makes up about 1 percent of the survey area. It is about 40 percent Rustlerpeak soils and 35 percent Farva soils. The remaining 25 percent is Woodseye soils on ridges and convex slopes; Hobit, Pinehurst, and Snowlin soils; Sibannac soils on concave slopes and near drainageways; and Rock outcrop.

Rustlerpeak soils have a surface layer of gravelly loam. The subsoil is very cobbly clay loam.

Farva soils have a surface layer of very cobbly loam. The subsoil and substratum are extremely cobbly loam.

This unit is used mainly for timber production, livestock grazing, or wildlife habitat.

The main limitations affecting timber production are erosion, compaction, plant competition, and the slope. Seedling mortality also is a major management concern, particularly on south-facing slopes and in areas where air drainage is restricted. Site preparation is needed to ensure adequate reforestation. The large number of rock fragments in the soils increases the seedling mortality rate. Air drainage is restricted in some areas. Proper timber harvesting methods can reduce the effects of frost on regeneration. High-lead or other cable logging systems should be used on the steeper slopes.

The main limitations affecting livestock grazing are compaction, erosion, and the slope. The slope limits access by livestock in some areas.

17. Farva-Pinehurst

Moderately deep and very deep, well drained soils that have a surface layer of very cobbly loam or loam

This map unit is on plateaus and hillslopes. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs. Slopes generally are 3 to 70 percent. Elevation is 3,600 to 5,500 feet. The mean annual precipitation is about 30 to 55 inches, the mean annual temperature is 40 to 45 degrees F, and the average frost-free period is less than 100 days.

This unit makes up about 5 percent of the survey area. It is about 65 percent Farva soils and 20 percent Pinehurst soils. The remaining 15 percent is Woodseye soils on ridges and convex slopes, Tatouche soils, Bybee and Kanutchan soils on concave slopes, Sibannac soils on concave slopes and near drainageways, and Rock outcrop.

Farva soils are moderately deep. The surface layer is very cobbly loam. The subsoil and substratum are extremely cobbly loam.

Pinehurst soils are very deep. The surface layer is loam. The subsoil is clay loam.

This unit is used mainly for timber production, livestock grazing, or wildlife habitat.

The main limitations affecting timber production are erosion, compaction, plant competition, and the slope. Seedling mortality also is a major management concern, particularly on south-facing slopes and in areas where air drainage is restricted. Site preparation is needed to ensure adequate reforestation. The large number of rock fragments in the Farva soils increases the seedling mortality rate. Air drainage is restricted in some areas. Proper timber harvesting methods can reduce the effects of frost on regeneration. High-lead or other cable logging systems should be used on the steeper slopes.

The main limitations affecting livestock grazing are compaction, erosion, and the slope. The slope limits access by livestock in some areas.

Soils Formed in Material Weathered From Altered Sedimentary and Igneous Rock on Ridges and Hillslopes

These soils make up about 23 percent of the survey area.

18. Acker-Norling-Kanid

Very deep, moderately deep, and deep, well drained soils that have a surface layer of gravelly loam or very gravelly loam

This map unit is on hillslopes. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs. Slopes generally are 12 to 80 percent. Elevation is 2,400 to 4,100 feet. The mean annual precipitation is about 45 to 60 inches, the mean annual temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 160 days.

This unit makes up about 1 percent of the survey area. It is about 30 percent Acker soils, 20 percent Norling soils, and 15 percent Kanid soils. The remaining 35 percent is Abegg soils on alluvial fans; Dumont soils on concave slopes and gently sloping hillslopes; Atring soils on steep hillslopes; Dubakella, Gravecreek, and Pearsoll soils, which formed in material derived from serpentinitic rock; Jayar soils at elevations of more than 4,000 feet; and Jayar Variant soils at elevations of more than 4,700 feet.

Acker soils are very deep. The surface layer is gravelly loam. The subsoil is gravelly clay loam.

Norling soils are moderately deep. The surface layer is very gravelly loam. The subsoil is gravelly and very cobbly clay loam.

Kanid soils are deep. The surface layer is very gravelly loam. The subsoil is very gravelly clay loam.

This unit is used mainly for timber production or wildlife habitat. The main limitations affecting timber production are erosion, compaction, plant competition, and the slope. Seedling mortality also is a major management concern, particularly on south-facing slopes. Site preparation is needed to ensure adequate reforestation. The large number of rock fragments in the Kanid soils increases the seedling mortality rate. High-lead or other cable logging systems should be used on the steeper slopes.

19. Josephine-Beekman-Speaker

Deep and moderately deep, well drained soils that have a surface layer of gravelly loam or loam

This map unit is on hillslopes. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs. Slopes generally are 12 to 80 percent. Elevation is 1,200 to 4,000 feet. The mean annual precipitation is about 40 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days.

This unit makes up about 5 percent of the survey area. It is about 30 percent Josephine soils, 20 percent Beekman soils, and 20 percent Speaker soils (fig. 3). The remaining 30 percent is Camas, Evans, and Newberg soils on flood plains; Abegg and Pollard soils on alluvial fans and concave slopes; McMullin soils on ridges and steep hillslopes; Dubakella and Pearsoll soils, which formed in material derived from serpentinitic rock; and Colestine soils on steep hillslopes.

Josephine soils are deep. The surface layer is gravelly loam. The subsoil is gravelly clay loam.

Beekman soils are moderately deep. The surface layer is gravelly loam. The subsoil is extremely gravelly loam.

Speaker soils are moderately deep. The surface layer is loam. The subsoil is loam and gravelly clay loam.

This unit is used mainly for timber production or wildlife habitat. The main limitations affecting timber production are erosion, compaction, plant competition, and the slope. Seedling mortality also is a major management concern, particularly on south-facing slopes. Site preparation is needed to ensure adequate reforestation. The large number of rock fragments in the Beekman soils increases the seedling mortality rate. High-lead or other cable logging systems should be used on the steeper slopes.

20. Vannoy-Caris-Offenbacher

Moderately deep, well drained soils that have a surface layer of silt loam or gravelly loam

This map unit is on hillslopes. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs. Slopes generally are 12 to 80 percent. Elevation is 1,000 to 4,000 feet. The mean annual precipitation is about 20 to 40 inches, the mean annual temperature is 46 to 54 degrees F, and the average frost-free period is 100 to 160 days.

This unit makes up about 15 percent of the survey area. It is about 35 percent Vannoy soils, 25 percent Caris soils, and 10 percent Offenbacher soils (fig. 2). The remaining 30 percent is Camas, Evans, and Newberg soils on flood plains; Abegg and Ruch soils on alluvial fans; Selmac soils on concave slopes; Manita and Shefflein soils on alluvial fans and gently sloping hillslopes; Dubakella soils, which formed in material derived from serpentinitic rock; McMullin soils on ridges and steep hillslopes; Tallowbox and Voorhies soils; and Jayar soils at elevations of more than 4,000 feet.

Vannoy soils have a surface layer of silt loam. The subsoil is clay loam, gravelly clay loam, and extremely gravelly clay loam.

Caris soils have a surface layer of gravelly loam. The subsoil is very gravelly clay loam and extremely gravelly loam.

Offenbacher soils have a surface layer of gravelly loam. The subsoil is loam.

This unit is used mainly for timber production or wildlife habitat. A few of the more gently sloping areas of the Vannoy soils are used for pasture or homesite development.

The main limitations affecting timber production are erosion, compaction, plant competition, and the slope. Seedling mortality also is a major management concern, particularly on south-facing slopes. Site preparation is needed to ensure adequate reforestation. The large number of rock fragments in the Caris soils increases the seedling mortality rate. High-lead or other cable logging systems should be used on the steeper slopes.

Irrigation can increase forage production on the Vannoy soils. The water supply, however, is limited.

The main limitations affecting homesite development on the Vannoy soils are the depth to bedrock, the slope, moderately slow permeability, and low strength.

21. Goolaway-Beekman-Musty

Moderately deep, well drained soils that have a surface layer of silt loam or gravelly loam

This map unit is on ridges and hillsides. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs. Slopes generally are 12 to 80 percent. Elevation is 1,500 to 4,000 feet. The mean annual precipitation is about 40 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days.

This unit makes up about 2 percent of the survey area. It is about 25 percent Goolaway soils, 20 percent Beekman soils, and 10 percent Musty soils. The remaining 45 percent is Colestine soils on steep hillslopes; Pollard and Wolfpeak soils on concave slopes; Josephine, Speaker, Tethrick, and Steinmetz soils; and Snowbrier soils at elevations of more than 3,600 feet.

Goolaway soils have a surface layer and subsoil of silt loam.

Beekman soils have a surface layer of gravelly loam. The subsoil is extremely gravelly loam.

Musty soils have a surface layer of gravelly loam. The subsoil is very cobbly loam.

This unit is used mainly for timber production or wildlife habitat. The main limitations affecting timber production are erosion, compaction, plant competition, and the slope. Seedling mortality also is a major management concern, particularly on south-facing slopes. The hazard of erosion is high. Management that minimizes erosion is essential when timber is harvested. Site preparation is needed to ensure adequate reforestation. The large number of rock fragments in the Beekman and Musty soils increases the seedling mortality rate. High-lead or other cable logging systems should be used on the steeper slopes.

Soils Formed in Material Weathered From Pyroclastics and Igneous Rock on Plateaus and Hillslopes

These soils make up about 16 percent of the survey area.

22. Hukill-Geppert

Deep and moderately deep, well drained soils that are gravelly loam in the upper part of the surface layer or have a surface layer of very cobbly loam

This map unit is on plateaus and hillslopes. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs. Slopes generally are 1 to 35 percent but are as much as 70 percent. Elevation is 2,000 to 3,000 feet. The mean annual precipitation is about 30 to 45 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days.

This unit makes up about 1 percent of the survey area. It is about 70 percent Hukill soils and 10 percent Geppert soils. The remaining 20 percent is Terrabella soils on concave slopes and Freezener soils.

Hukill soils are deep. The upper part of the surface layer is gravelly loam, and the lower part is gravelly clay loam. The subsoil is gravelly clay loam and gravelly clay.

Geppert soils are moderately deep. The surface layer is very cobbly loam. The subsoil is extremely cobbly clay loam.

This unit is used mainly for timber production, livestock grazing, or wildlife habitat.

The main limitations affecting timber production are compaction and plant competition on the Hukill soils and erosion, compaction, plant competition, and seedling mortality on the Geppert soils. Site preparation is needed to ensure adequate reforestation. The large number of rock fragments in the Geppert soils increases the seedling mortality rate. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction.

The main limitation affecting livestock grazing is compaction.

23. Crater Lake-Alcot-Barhiskey

Very deep, well drained, somewhat excessively drained, and excessively drained soils that have a surface layer of sandy loam, gravelly sandy loam, or gravelly loamy sand

This map unit is on plateaus, hillslopes, and outwash plains. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs. Slopes generally are 0 to 35 percent but are as much as 70 percent. Elevation is 2,000 to 3,200 feet. The mean annual precipitation is about 40 to 50 inches, the mean annual temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 150 days.

This unit makes up about 1 percent of the survey area. It is about 35 percent Crater Lake soils, 20 percent Alcot soils, and 20 percent Barhiskey soils (fig. 4). The remaining 25 percent is Sibannac soils near drainageways and Barhiskey Variant, Coyata, Dumont, and Reinecke soils.

Crater Lake soils are well drained. The surface layer, subsoil, and substratum are sandy loam.

Alcot soils are somewhat excessively drained. The surface layer and subsoil are gravelly sandy loam. The substratum is very cobbly sandy loam.

Barhiskey soils are excessively drained. The surface layer is gravelly loamy sand. The substratum is gravelly sand.

This unit is used mainly for timber production, livestock grazing, or wildlife habitat. A few areas are used for hay and pasture or for homesite development.

The main limitations affecting timber production are compaction, erosion, soil displacement, and plant competition. Seedling mortality also is a major management concern, particularly on south-facing slopes and in areas where air drainage is restricted. Site preparation is needed to ensure adequate reforestation. The sandy texture and low available water capacity of the Barhiskey soils increase the seedling mortality rate. Air drainage is restricted in some areas. Proper timber harvesting methods can reduce the effects of frost on regeneration. Displacement of the surface layer occurs most readily when the soils are dry. Compaction of the Crater Lake and Alcot soils can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction.

The main limitations affecting livestock grazing are compaction, soil displacement, and erosion.

The main limitations affecting homesite development are very rapid or rapid permeability, a high content of volcanic ash and pumice in the Crater Lake and Alcot soils, and a high content of sand in the Barhiskey soils.

24. Pokegema-Woodcock

Deep and very deep, well drained soils that are loam or stony loam in the upper part of the surface layer

This map unit is on hillslopes and plateaus. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs. Slopes generally are 1 to 55 percent. Elevation is 3,800 to 6,600 feet. The mean annual precipitation is about 25 to 35 inches, the mean annual temperature is 40 to 45 degrees F, and the average frost-free period is less than 100 days.

This unit makes up about 9 percent of the survey area. It is about 50 percent Pokegema soils and 35 percent Woodcock soils. The remaining 15 percent is Klamath soils on concave slopes and near drainageways and Aspenlake and Whiteface soils on alluvial fans.

Pokegema soils are deep. The upper part of the surface layer is loam, and the lower part is clay loam. The subsoil and substratum are gravelly clay.

Woodcock soils are very deep. The upper part of the surface layer is stony loam, and the lower part is very gravelly loam. The subsoil is very gravelly clay loam.

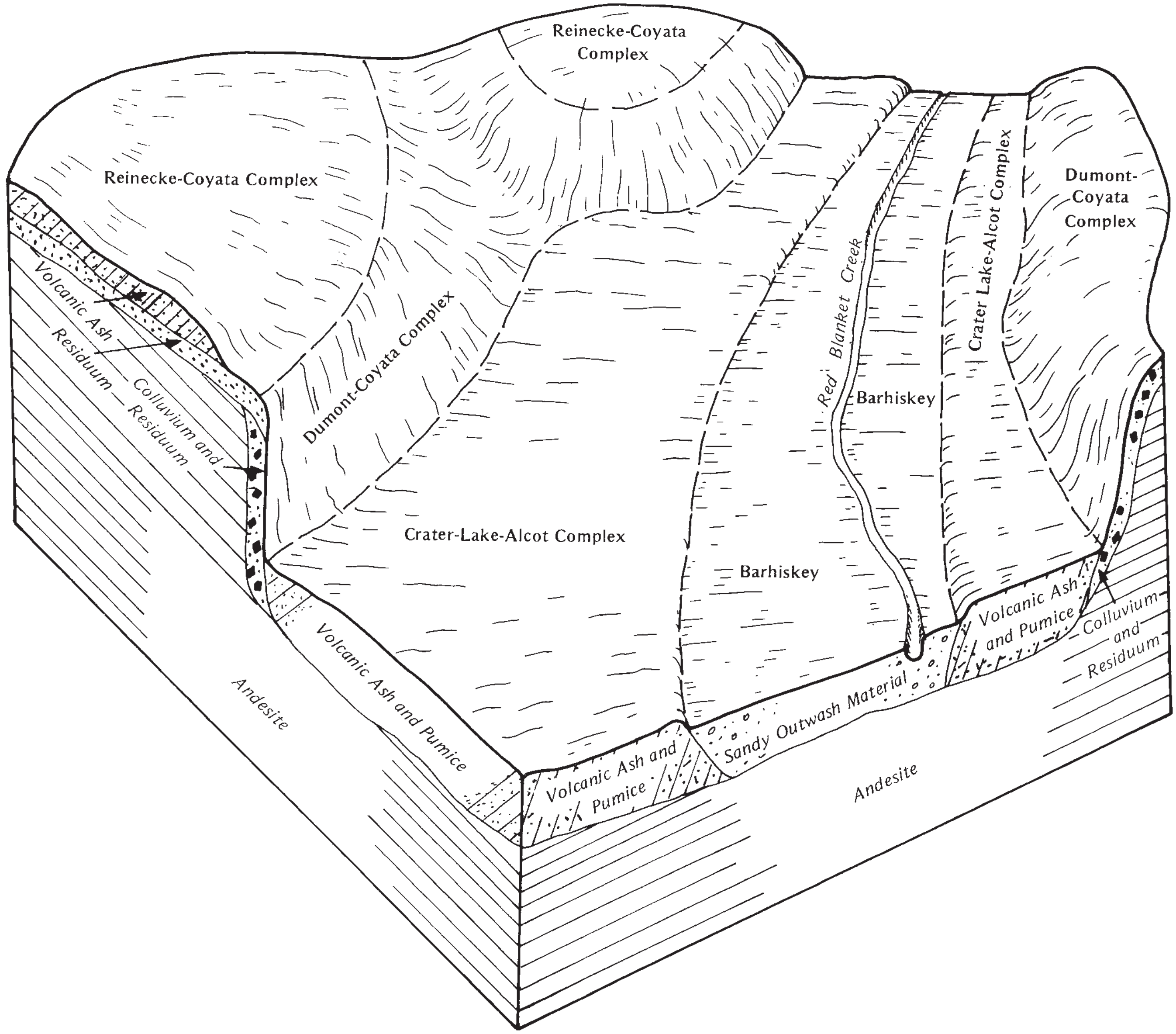

Figure 4.—Typical pattern of soils in the Crater Lake-Alcot-Barhiskey general map unit.

The substratum is gravelly clay loam.

This unit is used mainly for timber production, livestock grazing, or wildlife habitat.

The main limitations affecting timber production are erosion, compaction, plant competition, and the slope. Seedling mortality also is a major management concern, particularly on south-facing slopes and in areas where air drainage is restricted. Site preparation is needed to ensure adequate reforestation. The large number of rock fragments in the Woodcock soils increases the seedling mortality rate. Air drainage is restricted in some areas. Proper timber harvesting methods can reduce the effects of frost on regeneration. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. High-lead or other cable logging systems should be used on the steeper slopes.

The main limitations affecting livestock grazing are compaction, erosion, and the slope. The slope limits access by livestock in some areas.

25. Pinehurst-Greystoke-Bly

Very deep and deep, well drained soils that have a surface layer of loam or are stony loam in the upper part of the surface layer

This map unit is on hillsides and plateaus. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs. Slopes generally are 1 to 75 percent. Elevation is 3,000 to 5,200 feet. The mean annual precipitation is about 15 to 30 inches, the mean annual temperature is 42 to 46 degrees F, and the average frost-free period is less than 100 days.

This unit makes up about 4 percent of the survey area. It is about 40 percent Pinehurst soils, 25 percent Greystoke soils, and 10 percent Bly soils. The remaining 25 percent is Kanutchan soils on concave slopes and Booth, Kanutchan Variant, Lorella, Merlin, and Royst soils.

Pinehurst soils formed in colluvium derived from igneous rock. Greystoke soils formed in colluvium and residuum derived from igneous rock. Bly soils formed in sediment derived from igneous rock and volcanic ash.

Pinehurst soils are very deep. The surface layer is loam. The subsoil is clay loam.

Greystoke soils are deep. The upper part of the surface layer is stony loam, and the lower part is very cobbly loam. The subsoil is very cobbly loam and extremely gravelly clay loam.

Bly soils are very deep. The surface layer is loam. The subsoil is clay loam.

This unit is used mainly for timber production, livestock grazing, or wildlife habitat.

The main limitations affecting timber production are erosion, compaction, plant competition, and the slope. Seedling mortality also is a major management concern, particularly on south-facing slopes and in areas where air drainage is restricted. Site preparation is needed to ensure adequate reforestation. The large number of rock fragments in the Greystoke soils increases the seedling mortality rate. Air drainage is restricted in some areas. Proper timber harvesting methods can reduce the effects of frost on regeneration. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. High-lead or other cable logging systems should be used on the steeper slopes.

The main limitations affecting livestock grazing are compaction, erosion, and the slope. The slope limits access by livestock in some areas.

26. Campfour-Paragon

Very deep and moderately deep, well drained soils that have a surface layer of loam or cobbly loam

This map unit is on plateaus and hillslopes. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs. Slopes generally are 1 to 35 percent. Elevation is 3,000 to 4,400 feet. The mean annual precipitation is about 20 to 25 inches, the mean annual temperature is 45 to 51 degrees F, and the average frost-free period is 100 to 130 days.

This unit makes up about 1 percent of the survey area. It is about 35 percent Campfour soils and 30 percent Paragon soils. The remaining 35 percent is Shoat soils on mounds in areas of patterned ground, Randcore soils between the mounds in areas of patterned ground, McMullin soils on ridges and steep hillslopes, and Skookum soils.

Campfour soils are very deep. The surface layer is loam. The subsoil is clay loam and gravelly clay loam.

Paragon soils are moderately deep. The surface layer is cobbly loam. The subsoil is gravelly clay loam.

This unit is used mainly for timber production, livestock grazing, or wildlife habitat.

The main limitations affecting timber production are compaction and erosion. Seedling mortality also is a major management concern, particularly on south-facing slopes and in areas where air drainage is restricted. The large number of rock fragments in the Paragon soils increases the seedling mortality rate. Air drainage is restricted in some areas. Proper timber harvesting methods can reduce the effects of frost on regeneration. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction.

The main limitations affecting livestock grazing are compaction and erosion.

Detailed Soil Map Units

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

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

Most included soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, inclusions. They may or may not be mentioned in the map unit description. Other included soils and miscellaneous areas, however, have properties and behavioral characteristics 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 is needed to define and locate the soils and miscellaneous areas.

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, acidity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Carney clay, 1 to 5 percent slopes, is a phase of the Carney series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes. 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. Agate-Winlo complex, 0 to 5 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 4 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

1B—Abegg gravelly loam, 2 to 7 percent slopes. This very deep, well drained soil is on alluvial fans. It formed in alluvium derived dominantly from metamorphic rock. Elevation is 1,000 to 2,500 feet. The mean annual precipitation is 30 to 40 inches, the mean annual temperature is 50 to 54 degrees F, and the average frost-free period is 140 to 180 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about ½ inch thick. The surface layer is very dark grayish brown gravelly loam about 5 inches thick. The next layer is very dark grayish brown and brown very gravelly loam about 17 inches thick. The upper 16 inches of the subsoil is dark yellowish brown extremely gravelly loam. The lower 28 inches is brown and yellowish brown extremely gravelly clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is cobbly or stony.

Included in this unit are small areas of Xerorthents; Ruch and Vannoy soils; Camas, Evans, and Newberg soils on flood plains; and Takilma soils on terraces. Also included are small areas of soils that are similar to the Abegg soil but have bedrock at a depth of 40 to 60 inches, poorly drained soils near drainageways, and Abegg soils that have slopes of more than 7 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderate in the Abegg soil. Available water capacity is about 4 inches. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used mainly for hay and pasture. It also is used for timber production and homesite development.

This unit is suited to hay and pasture. It is limited mainly by droughtiness and a large number of rock fragments on and below the surface. The rock fragments limit the use of equipment and increase maintenance costs.

In summer, irrigation is needed for the maximum production of most forage crops. Sprinkler irrigation is the best method of applying water. This method permits an even, controlled application of water, helps to prevent excessive runoff, and minimizes the risk of erosion. Border and contour flood irrigation systems also are suitable. For the efficient application and removal of surface irrigation water, land leveling is needed. To prevent overirrigation and the leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. Because the soil is droughty, the applications should be light and frequent. The use of pipe, ditch lining, or drop structures in irrigation ditches reduces water loss and the hazard of erosion.

Proper stocking rates, pasture rotation, and deferment of grazing during wet periods help to keep pastures in good condition, minimize compaction, and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

The main limitation affecting homesite development is the large number of rock fragments on and below the surface. Cutbanks are not stable and are subject to slumping. To keep cutbanks from caving in, excavations may require special retainer walls. Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites.

Establishing plants is difficult in areas where the surface layer has been removed and the extremely gravelly subsoil exposed. Mulching and applying fertilizer help to establish plants in cut areas. Gravel and cobbles should be removed from disturbed areas, particularly areas used for lawns. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. In many areas it may be necessary to haul in topsoil for lawns and gardens. Because of droughtiness and a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

This unit is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include incense cedar, California black oak, and Pacific madrone. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and California fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 115. The yield at culmination of the mean annual increment is 6,360 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 50,700 board feet per acre (Scribner rule) at 130 years. On the basis of a 50-year curve, the mean site index is 90.

The main limitations affecting timber production are compaction, seedling mortality, and plant competition. Conventional methods of harvesting timber generally are suitable, but the soil may be compacted if it is moist when heavy equipment is used. Puddling can occur when the soil is wet. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Erosion can be controlled by carefully planning the construction and maintenance of logging roads, skid trails, and landings. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. The large number of rock fragments in the soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The vegetative site is Pine-Douglas Fir-Fescue.

1C—Abegg gravelly loam, 7 to 12 percent slopes. This very deep, well drained soil is on alluvial fans. It formed in alluvium derived dominantly from metamorphic rock. Elevation is 1,000 to 2,500 feet. The mean annual precipitation is 30 to 40 inches, the mean annual temperature is 50 to 54 degrees F, and the average frost-free period is 140 to 180 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about ½ inch thick. The surface layer is very dark grayish brown gravelly loam about 5 inches thick. The next layer is very dark grayish brown and brown very gravelly loam about 17 inches thick. The upper 16 inches of the subsoil is dark yellowish brown extremely gravelly loam. The lower 28 inches is brown and yellowish brown extremely gravelly clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is cobbly or stony.

Included in this unit are small areas of Xerorthents; Ruch and Vannoy soils; Camas, Evans, and Newberg soils on flood plains; and Takilma soils on terraces. Also included are small areas of soils that are similar to the Abegg soil but have bedrock at a depth of 40 to 60 inches, poorly drained soils near drainageways, and Abegg soils that have slopes of less than 7 or more than 12 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderate in the Abegg soil. Available water capacity is about 4 inches. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used mainly for hay and pasture. It also is used for timber production and homesite development.

This unit is suited to hay and pasture. It is limited mainly by the slope, droughtiness, and the large number of rock fragments on and below the surface. The rock fragments limit the use of equipment and increase maintenance costs.

In summer, irrigation is needed for the maximum production of most forage crops. Because of the slope, sprinkler irrigation is the best method of applying water. This method permits an even, controlled application of water, helps to prevent excessive runoff, and minimizes the risk of erosion. To prevent overirrigation and excessive erosion, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. Because the soil is droughty, the applications should be light and frequent.

Seedbeds should be prepared on the contour or across the slope where practical. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth.

Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

The main limitations affecting homesite development are the large number of rock fragments on and below the surface and the slope. Cutbanks are not stable and are subject to slumping. To keep cutbanks from caving in, excavations may require special retainer walls. Erosion is a hazard on the steeper slopes. Only the part of the site that is used for construction should be disturbed. Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites.

Establishing plants is difficult in areas where the surface layer has been removed and the extremely gravelly subsoil exposed. Mulching and applying fertilizer help to establish plants in cut areas. Gravel and cobbles should be removed from disturbed areas, particularly areas used for lawns. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. In many areas it may be necessary to haul in topsoil for lawns and gardens. Because of droughtiness and a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

This unit is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include incense cedar, California black oak, and Pacific madrone. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and California fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 115. The yield at culmination of the mean annual increment is 6,360 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 50,700 board feet per acre (Scribner rule) at 130 years. On the basis of a 50-year curve, the mean site index is 90.

The main limitations affecting timber production are compaction, seedling mortality, and plant competition. Conventional methods of harvesting timber generally are suitable, but the soil may be compacted if it is moist when heavy equipment is used. Puddling can occur when the soil is wet. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Erosion can be controlled by carefully planning the construction and maintenance of logging roads, skid trails, and landings. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. The large number of rock fragments in the soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The vegetative site is Pine-Douglas Fir-Fescue.

2A—Abin silty clay loam, 0 to 3 percent slopes. This very deep, moderately well drained soil is on flood plains. It formed in alluvium derived from mixed sources. Elevation is 1,000 to 2,500 feet. The mean annual precipitation is 18 to 35 inches, the mean annual temperature is 50 to 54 degrees F, and the average frost-free period is 140 to 180 days. The native vegetation in areas that have not been cultivated is mainly hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is very dark grayish brown silty clay loam about 34 inches thick. The upper 10 inches of the substratum is very dark brown silty clay loam. The lower part to a depth of 65 inches is very dark grayish brown silty clay loam.

Included in this unit are small areas of Evans, Newberg, and Camas soils; Central Point, Gregory, and Medford soils on terraces; and Cove soils on concave slopes. Also included are small areas of Abin soils that have slopes of more than 3 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderately slow in the Abin soil. Available water capacity is about 11 inches. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The water table fluctuates between depths of 3 and 5 feet from December through April. This soil is occasionally flooded for brief periods from December through April.

This unit is used mainly for irrigated crops, such as alfalfa hay and small grain. Other crops include corn for silage and tree fruit. Some areas are used for grass-legume hay, pasture, or homesite development.

This unit is suited to irrigated crops. It is limited mainly by the hazard of flooding, the moderately slow permeability, and wetness in winter and spring. The risk of flooding can be reduced by levees, dikes, and diversions.

In summer, irrigation is needed for the maximum production of most crops. Furrow, border, corrugation, trickle, and sprinkler irrigation systems are suitable. The system used generally is governed by the crop that is grown. For the efficient application and removal of surface irrigation water, land leveling is needed. To prevent overirrigation and excessive erosion, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. The use of pipe, ditch lining, or drop structures in irrigation ditches reduces water loss and the hazard of erosion.

A subsurface drainage system can lower the water table if a suitable outlet is available. Land smoothing and open ditches can reduce surface wetness.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Leaving crop residue on or near the surface helps to conserve moisture and control erosion.

A tillage pan forms easily if the soil is tilled when wet. Chiseling or subsoiling breaks up the pan. Surface crusting and compaction can be minimized by returning crop residue to the soil.

Solid-set sprinkler irrigation is the best method of controlling frost and providing adequate moisture for tree fruit. Compaction can be minimized by limiting the use of equipment when the soil is wet and by planting a cover crop. A permanent cover crop helps to control runoff and erosion.

Maintaining a protective plant cover in winter reduces the soil loss resulting from flooding. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

The main limitations affecting homesite development are the flooding, the moderately slow permeability, the wetness, the shrink-swell potential, and low strength.

The wetness, the moderately slow permeability, and the hazard of flooding increase the possibility that septic tank absorption fields will fail. The moderately slow permeability can be overcome by increasing the size of the absorption field. Interceptor ditches can divert subsurface water and thus improve the efficiency of the absorption fields. Dikes and channels that have outlets for floodwater can protect buildings and onsite sewage disposal systems from flooding. Alternative waste disposal systems may function properly on this unit. Suitable included soils are throughout the unit. Onsite investigation is needed to locate such soils.

A drainage system is needed if roads or building foundations are constructed on this unit. The wetness can be reduced by installing drainage tile around footings. Properly designing foundations and footings, diverting runoff away from the buildings, and backfilling with material that has a low shrink-swell potential help to prevent the structural damage caused by shrinking and swelling. Properly designing buildings and roads helps to offset the limited ability of the soil to support a load.

Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

Roads and streets should be constructed above the expected level of flooding. The risk of flooding has been reduced in some areas by the construction of large dams and reservoirs upstream.

The vegetative site is Loamy Flood Plain, 18- to 30-inch precipitation zone.

3E—Acker-Dumont complex, 12 to 35 percent north slopes. This map unit is on hillslopes. Elevation is 2,400 to 4,000 feet. The mean annual precipitation is 45 to 60 inches, the mean annual temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 45 percent Acker soil and 30 percent Dumont soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Dubakella, Gravecreek, Norling, and Pearsoll soils; Abegg soils on alluvial fans and near drainageways; Atring and Kanid soils on the more sloping parts of the landscape and on convex slopes; and poorly drained soils near drainageways. Also included are small areas of Acker and Dumont soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 25 percent of the total acreage.

The Acker soil is very deep and well drained. It formed in colluvium derived dominantly from metamorphic rock. Typically, the surface is covered with a layer of needles, leaves, and twigs about 4 inches thick. The surface layer is brown gravelly loam about 8 inches thick. The next layer is yellowish brown gravelly clay loam about 9 inches thick. The upper 11 inches of the subsoil is yellowish red gravelly clay loam. The lower 32 inches is strong brown gravelly clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is stony.

Permeability is moderately slow in the Acker soil. Available water capacity is about 7 inches. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

The Dumont soil is very deep and well drained. It formed in colluvium derived dominantly from metamorphic rock. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is dark reddish brown gravelly clay loam about 4 inches thick. The next layer is dark reddish brown clay loam about 11 inches thick. The upper 36 inches of the subsoil is yellowish red clay. The lower 9 inches is yellowish red clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is stony.

Permeability is moderately slow in the Dumont soil. Available water capacity is about 9 inches. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir. Other species that grow on this unit include incense cedar, western hemlock, and Pacific madrone. The understory vegetation includes golden chinkapin, salal, and cascade Oregongrape.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 135 on both the Acker and Dumont soils. The yield at culmination of the mean annual increment is 8,280 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 63,910 board feet per acre (Scribner rule) at 110 years. On the basis of a 50-year curve, the mean site index is 100.

The main limitations affecting timber production are erosion, compaction, and plant competition on both soils and the hazard of slumping on the Dumont soil. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. Using standard wheeled and tracked equipment when the soils are moist causes rutting and compaction. Puddling can occur when the soils are wet. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both.

The Dumont soil is subject to slumping. Road failure and landslides are likely to occur after road construction and clearcutting. Slumping can be minimized by constructing logging roads in the less sloping areas, on better suited soils if practical, and by installing properly designed road drainage systems. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The vegetative site is Mixed Fir-Salal (rhododendron) Forest.

4E—Acker-Dumont complex, 12 to 35 percent south slopes. This map unit is on hillslopes. Elevation is 2,400 to 4,000 feet. The mean annual precipitation is 45 to 60 inches, the mean annual temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 40 percent Acker soil and 30 percent Dumont soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Dubakella, Gravecreek, Norling, and Pearsoll soils; Abegg soils on alluvial fans and near drainageways; Atring and Kanid soils on the more sloping parts of the landscape and on convex slopes; and poorly drained soils near drainageways. Also included are small areas of Acker and Dumont soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 30 percent of the total acreage.

The Acker soil is very deep and well drained. It formed in colluvium derived dominantly from metamorphic rock. Typically, the surface is covered with a layer of needles, leaves, and twigs about 4 inches thick. The surface layer is brown gravelly loam about 8 inches thick. The next layer is yellowish brown gravelly clay loam about 9 inches thick. The upper 11 inches of the subsoil is yellowish red gravelly clay loam. The lower 32 inches is strong brown gravelly clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is stony.

Permeability is moderately slow in the Acker soil. Available water capacity is about 7 inches. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

The Dumont soil is very deep and well drained. It formed in colluvium derived dominantly from metamorphic rock. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is dark reddish brown gravelly clay loam about 4 inches thick. The next layer is dark reddish brown clay loam about 11 inches thick. The upper 36 inches of the subsoil is yellowish red clay. The lower 9 inches is yellowish red clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is stony.

Permeability is moderately slow in the Dumont soil. Available water capacity is about 9 inches. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir. Other species that grow on this unit include incense cedar, sugar pine, and Pacific madrone. The understory vegetation includes golden chinkapin, Whipplevine, and cascade Oregongrape.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 130 on both the Acker and Dumont soils. The yield at culmination of the mean annual increment is 7,740 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 58,520 board feet per acre (Scribner rule) at 110 years. On the basis of a 50-year curve, the mean site index is 95.

The main limitations affecting timber production are erosion, compaction, seedling mortality, and plant competition on both soils and slumping on the Dumont soil. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. Using standard wheeled and tracked equipment when the soils are moist causes rutting and compaction. Puddling can occur when the soils are wet. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both.

Because the Dumont soil is subject to slumping, road failure and landslides are likely to occur after road construction and clearcutting. Slumping can be minimized by constructing logging roads in the less sloping areas, on better suited soils if practical, and by installing properly designed road drainage systems. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The vegetative site is Douglas Fir-Madrone-Chinkapin Forest.

5F—Acker-Norling complex, 35 to 55 percent north slopes. This map unit is on hillslopes. Elevation is 2,400 to 4,000 feet. The mean annual precipitation is 45 to 60 inches, the mean annual temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 50 percent Acker soil and 35 percent Norling soil. The components of this unit occur as areas so intricately intermingled that mapping them

separately was not practical at the scale used.

Included in this unit are small areas of Dubakella, Gravecreek, and Pearsoll soils; Dumont soils on the less sloping parts of the landscape and on concave slopes; and Atring and Kanid soils on the more sloping parts of the landscape and on convex slopes. Also included are small areas of Acker and Norling soils that have slopes of less than 35 or more than 55 percent. Included areas make up about 15 percent of the total acreage.

The Acker soil is very deep and well drained. It formed in colluvium derived dominantly from metamorphic rock. Typically, the surface is covered with a layer of needles, leaves, and twigs about 4 inches thick. The surface layer is brown gravelly loam about 8 inches thick. The next layer is yellowish brown gravelly clay loam about 9 inches thick. The upper 11 inches of the subsoil is yellowish red gravelly clay loam. The lower 32 inches is strong brown gravelly clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is stony.

Permeability is moderately slow in the Acker soil. Available water capacity is about 7 inches. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

The Norling soil is moderately deep and well drained. It formed in colluvium derived dominantly from metamorphic rock. Typically, the surface is covered with a layer of needles, leaves, and twigs about 2 inches thick. The surface layer is brown very gravelly loam about 5 inches thick. The next layer is brown gravelly clay loam about 5 inches thick. The upper 12 inches of the subsoil is yellowish brown gravelly clay loam. The lower 7 inches is yellowish brown very cobbly clay loam. Weathered bedrock is at a depth of about 29 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Permeability is moderate in the Norling soil. Available water capacity is about 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir. Other species that grow on this unit include incense cedar, golden chinkapin, and western hemlock. The understory vegetation includes salal, cascade Oregongrape, and deerfoot vanillaleaf.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 135 on the Acker soil. The yield at culmination of the mean annual increment is 8,280 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 63,910 board feet per acre (Scribner rule) at 110 years. On the basis of a 50-year curve, the mean site index is 100.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 130 on the Norling soil. The yield at culmination of the mean annual increment is 7,740 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 58,520 board feet per acre (Scribner rule) at 110 years. On the basis of a 50-year curve, the mean site index is 95.

The main limitations affecting timber production are the slope, erosion, compaction, and plant competition. Also, root growth is restricted by the bedrock underlying the Norling soil. As a result, trees are subject to windthrow.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. Using standard wheeled and tracked equipment when the soils are moist causes rutting and compaction. Puddling can occur when the soils are wet. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soils are saturated.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The vegetative site is Mixed Fir-Salal (rhododendron) Forest.

6B—Agate-Winlo complex, 0 to 5 percent slopes. This map unit is on fan terraces. Elevation is 1,100 to 1,850 feet. The mean annual precipitation is 18 to 30 inches, the mean annual temperature is 52 to 54 degrees F, and the average frost-free period is 150 to 180 days. The native vegetation is mainly grasses, shrubs, and forbs.

This unit is about 55 percent Agate soil and 35 percent Winlo soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used. The soils occur as patterned land. Areas of the Winlo soil are between and around areas of the Agate soil, which is on circular mounds.

Included in this unit are small areas of Cove and Padigan soils on concave slopes and near drainageways; Provig soils, which have slopes of more than 3 percent; Brader and Debenger soils on slightly raised knolls; and, West of Phoenix, small areas of soils that are similar to the Agate soil but are underlain by weakly cemented gravel and do not occur in a patterned land complex. Also included are small areas of Agate and Winlo soils that have slopes of more than 5 percent. Included areas make up about 10 percent of the total acreage.

The Agate soil is moderately deep to a hardpan and is well drained. It formed in alluvium derived from mixed sources. Typically, the surface layer is dark brown loam about 6 inches thick. The next layer is dark yellowish brown clay loam about 6 inches thick. The upper 13 inches of the subsoil is dark brown clay loam. The lower 5 inches is a hardpan. The substratum to a depth of 62 inches is light olive brown extremely gravelly coarse sandy loam. Depth to the hardpan is 20 to 30 inches. The depth to bedrock is 60 inches or more. In some areas the surface layer is gravelly or cobbly.

Permeability is moderately slow in the Agate soil. Available water capacity is about 4 inches. The effective rooting depth is 20 to 30 inches. Runoff is slow, and the hazard of water erosion is slight.

The Winlo soil is shallow to a hardpan and is somewhat poorly drained. It formed in alluvium derived from mixed sources. Typically, the surface layer is very dark grayish brown very gravelly clay loam about 4 inches thick. The upper 5 inches of the subsoil is dark brown very gravelly clay. The lower 8 inches is a hardpan. The substratum to a depth of 60 inches is light olive brown extremely gravelly coarse sandy loam. Depth to the hardpan is 7 to 15 inches. The depth to bedrock is 60 inches or more. In some areas the surface layer is very cobbly or very gravelly clay.

Permeability is slow in the Winlo soil. Available water capacity is about 1 inch. The effective rooting depth is 7 to 15 inches. Runoff is ponded, and the hazard of water erosion is slight. The water table fluctuates between 0.5 foot above and 0.5 foot below the surface from December through April.

This unit is used for hay and pasture, homesite development, and livestock grazing.

The main limitations in the areas used for hay and pasture are wetness in winter and spring, droughtiness in summer and fall, depth to the hardpan, compaction, and the very gravelly surface layer of the Winlo soil. In some areas ripping and shattering the hardpan increase the effective rooting depth and improve drainage.

If the pasture or range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. The grazing system should maintain the desired balance of species in the plant community. The wetness of the Winlo soil limits the choice of suitable forage plants and the period of cutting or grazing and increases the risk of winterkill. The use of ground equipment is limited by the gravel and cobbles on the surface of the Winlo soil. Proper stocking rates, pasture rotation, and deferred grazing during wet periods help to keep the pasture or range in good condition and protect the soils from erosion. Grazing when the soils are wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth.

The native vegetation suitable for grazing includes bluebunch wheatgrass, Lemmon needlegrass, and Idaho fescue on the Agate soil and timothy and other wet-meadow grasses on the Winlo soil. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment.

Range seeding is suitable if the site is in poor condition. The main limitations are wetness in winter and spring, droughtiness in summer and fall, and depth to the hardpan in the Winlo soil. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

In summer, irrigation is needed for the maximum production of most forage crops. Sprinkler irrigation is the best method of applying water. This method permits an even, controlled application of water, helps to prevent excessive runoff, and minimizes the risk of erosion. Border and contour flood irrigation systems also are suitable. To prevent overirrigation and the development of a perched water table, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. For the efficient application and removal of surface irrigation water, leveling is needed on the more sloping parts of the landscape. Deep cuts, however, can expose the hardpan. The use of pipe, ditch lining, or drop structures in irrigation ditches reduces water loss and the hazard of erosion. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

The main limitations affecting homesite development are the wetness and very gravelly surface layer in the Winlo soil and depth to the hardpan in both soils.

These soils are poorly suited to standard systems of waste disposal because of depth to the hardpan in both soils and the wetness in the Winlo soil. The suitability of the soils for septic tank absorption fields can be improved by ripping the hardpan, which improves permeability and drainage. Alternative waste disposal systems may function properly on these soils. Suitable included soils are in some areas of this unit. Onsite investigation is needed to locate such soils.

Because of the seasonal high water table perched above the hardpan in the Winlo soil, a drainage system is needed on sites for buildings with basements and crawl spaces. It also is needed if roads or building foundations are constructed. Excess water can be removed by suitably designed drainage ditches.

Establishing plants is difficult in areas where the surface layer has been removed and the hardpan exposed. Mulching and applying fertilizer help to establish plants in cut areas. Gravel and cobbles should be removed from disturbed areas, particularly areas used for lawns. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. In many areas it may be necessary to haul in topsoil for lawns and gardens. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

The vegetative site in areas of the Agate soil is Biscuit-Scabland (mound), 18- to 26-inch precipitation zone, and the one in areas of the Winlo soil is Poorly Drained Bottom.

7C—Aspenlake-Whiteface complex, 1 to 12 percent slopes. This map unit is on alluvial fans. Elevation is 4,000 to 4,500 feet. The mean annual precipitation is 20 to 35 inches, the mean annual temperature is 40 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

This unit is about 45 percent Aspenlake soil and 30 percent Whiteface soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Hoxie, Pokegema, and Woodcock soils; poorly drained soils near drainageways and on concave slopes; and soils that are similar to the Aspenlake soil but have a hardpan at a depth of more than 40 inches. Also included are small areas of soils that are similar to the Whiteface soil but have a hardpan within a depth of 10 inches and Aspenlake and Whiteface soils that have slopes of more than 12 percent. Included areas make up about 25 percent of the total acreage.

The Aspenlake soil is moderately deep to a hardpan and is well drained. It formed in alluvium derived dominantly from andesite. Typically, the surface layer is dark brown stony loam about 4 inches thick. The next layer is dark brown gravelly loam about 6 inches thick. The upper 16 inches of the subsoil also is dark brown gravelly loam. The lower 7 inches is a hardpan. Depth to the hardpan is 20 to 40 inches.

Permeability is moderate in the Aspenlake soil. Available water capacity is about 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is slow, and the hazard of water erosion is slight.

The Whiteface soil is shallow to a hardpan and is well drained. It formed in alluvium derived dominantly from andesite. Typically, the surface layer is dark brown cobbly loam about 8 inches thick. The next layer is dark brown gravelly loam about 4 inches thick. The upper 4 inches of the subsoil is dark brown gravelly clay loam. The lower 7 inches is a hardpan. Depth to the hardpan is 10 to 20 inches.

Permeability is moderate in the Whiteface soil. Available water capacity is about 2 inches. The effective rooting depth is 10 to 20 inches. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of ponderosa pine. The plant community on the Aspenlake soil includes ponderosa pine, Douglas fir, and white fir. The understory vegetation is mainly Douglas spirea, common snowberry, and Idaho fescue. The plant community on the Whiteface soil includes ponderosa pine and a few other conifers. The understory vegetation is mainly birchleaf mountainmahogany, squawcarpet, and Ross sedge.

On the basis of a 100-year site curve, the mean site index for ponderosa pine on the Aspenlake soil is 90. The yield at culmination of the mean annual increment is 3,400 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 37,960 board feet per acre (Scribner rule) at 130 years.

On the basis of a 100-year site curve, the mean site index for ponderosa pine on the Whiteface soil is 75. The yield at culmination of the mean annual increment is 3,100 cubic feet per acre in a fully stocked, even-aged stand of trees at 50 years and 31,680 board feet per acre (Scribner rule) at 160 years.

The main limitations affecting timber production are compaction, erosion, seedling mortality, and plant competition. Also, the hardpan in the Whiteface soil restricts root growth. As a result, trees are subject to windthrow.

Conventional methods of harvesting timber generally are suitable, but the soils may be compacted if they are moist when heavy equipment is used. Puddling can occur when the soils are wet. If the soils are excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface or the hardpan in the Whiteface soil may be exposed. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Erosion can be controlled by carefully planning the construction and maintenance of logging roads, skid trails, and landings. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Severe frost can damage or kill seedlings. Air drainage may be restricted on this unit. Proper timber harvesting methods can reduce the effect of frost on regeneration. Reforestation can be accomplished by planting ponderosa pine seedlings.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. The large number of rock fragments in both soils and the shallowness of the Whiteface soil also increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The main limitations affecting livestock grazing are compaction and droughtiness. The Whiteface soil also is limited by depth to the hardpan. The native vegetation suitable for grazing includes Idaho fescue, sedge, western fescue, and Wheeler bluegrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soils. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the hazard of erosion.

The vegetative site in areas of the Aspenlake soil is Wet Loamy Terrace, and the one in areas of the Whiteface soil is Ponderosa Pine-Fescue.

8A—Barhiskey gravelly loamy sand, 0 to 3 percent slopes. This very deep, excessively drained soil is on outwash plains. It formed in sandy alluvium mixed with pumice and volcanic ash. Elevation is 2,500 to 3,000 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 150 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles and twigs about 1 inch thick. The surface layer is black gravelly loamy sand about 4 inches thick. The next layer is dark brown gravelly sand about 15 inches thick. The substratum to a depth of 60 inches is very dark gray gravelly sand. The depth to bedrock is 60 inches or more. In some areas the surface layer is cobbly.

Included in this unit are small areas of Alcot, Barhiskey Variant, and Crater Lake soils and soils that are similar to the Barhiskey soil but have more than 35 percent rock fragments. Also included are small areas of Barhiskey soils that have slopes of more than 3 percent. Included areas make up about 15 percent of the total acreage.

Permeability is rapid in the Barhiskey soil. Available water capacity is about 4 inches. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include sugar pine and white fir. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 120. The yield at culmination of the mean annual increment is 6,900 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 52,440 board feet per acre (Scribner rule) at 120 years. On the basis of a 50-year curve, the mean site index is 90.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 110. The yield at culmination of the mean annual increment is 4,880 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 50,820 board feet per acre (Scribner rule) at 110 years.

The main limitations affecting timber production are seedling mortality and the sandy surface layer. The sandy surface layer hinders the use of wheeled and tracked logging equipment, especially when the soil is saturated or very dry. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction generally is not a problem on this unit. In areas where it is a concern, it can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. When dry, unsurfaced roads and skid trails are dusty. Logging roads require suitable surfacing for year-round use.

Severe frost can damage or kill seedlings. Air drainage may be restricted on this unit. Proper timber harvesting methods can reduce the effect of frost on regeneration.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. Reforestation can be accomplished by planting ponderosa pine and Douglas fir seedlings (fig. 5).

The main limitations affecting livestock grazing are droughtiness and soil displacement. The native vegetation suitable for grazing includes western fescue, tall trisetum, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock. Displacement of the surface layer occurs most readily when the soil is dry.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion. Success may be limited, however, because of droughtiness and soil displacement.

The vegetative site is Mixed Fir-Mixed Pine Forest.

9A—Barhiskey Variant gravelly loamy sand, 0 to 3 percent slopes. This very deep, somewhat poorly drained soil is on outwash plains. It formed in alluvium mixed with pumice and volcanic ash. Elevation is 2,500 to 2,700 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 150 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles and twigs about 1 inch thick. The surface layer is black gravelly loamy sand about 8 inches thick. The next layer is very dark grayish brown gravelly sand about 21 inches thick. The substratum to a depth of 60 inches is very dark gray gravelly sand. The depth to bedrock is 60 inches or more.

Included in this unit are small areas of Alcot, Barhiskey, and Crater Lake soils; soils that are similar to the Barhiskey Variant soil but have more than 35 percent rock fragments; and very poorly drained, organic soils in depressions and near drainageways. Also included are small areas of Barhiskey Variant soils that have slopes of more than 3 percent. Included areas make up about 10 percent of the total acreage.

Permeability is rapid in the Barhiskey Variant soil. Available water capacity is about 4 inches. The effective rooting depth is limited by the water table, which is at a depth of 1 to 3 feet from January through August. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for hay and pasture and for wildlife habitat. It is well suited to hay and pasture. The main limitations are wetness in winter and spring and droughtiness in summer and fall. Tile drainage can

Figure 5.—Ponderosa pine seedlings on Barhiskey gravelly loamy sand, 0 to 3 percent slopes.

lower the water table if a suitable outlet is available. Land smoothing and open ditches can reduce surface wetness.

In summer, irrigation is needed for the maximum production of most forage crops. Because the rate of water intake is rapid, sprinkler irrigation is the best method of applying water. This method permits an even, controlled application of water, helps to prevent excessive runoff, and minimizes the risk of erosion. To prevent overirrigation and the leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. Because the soil is droughty, the applications should be light and frequent.

Wetness limits the choice of suitable forage plants and the period of cutting or grazing and increases the risk of winterkill. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

This unit is limited as a site for livestock watering ponds and other water impoundments because of seepage.

The vegetative site is Mixed Fir-Mixed Pine Forest, Wet.

10B—Barron coarse sandy loam, 0 to 7 percent slopes. This very deep, somewhat excessively drained soil is on alluvial fans. It formed in alluvium derived dominantly from granitic rock. Elevation is 1,000 to 2,500 feet. The mean annual precipitation is 18 to 35 inches, the mean annual temperature is 50 to 54 degrees F, and the average frost-free period is 120 to 180 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is dark brown coarse sandy loam about 6 inches thick. The subsoil is brown sandy loam about 17 inches thick. The upper 14 inches of the substratum is dark yellowish brown sandy loam. The lower part to a depth of 60 inches is brown sandy loam. The depth to bedrock is 60 inches or more.

Included in this unit are small areas of Clawson and Kubli soils near drainageways and on concave slopes, Central Point soils on the lower parts of the landscape, and Ruch and Shefflein soils. Also included are small areas of Barron soils that have slopes of more than 7 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderately rapid in the Barron soil. Available water capacity is about 6 inches. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used mainly for irrigated crops, such as alfalfa hay, small grain, tree fruit, and grass-legume hay. It also is used for timber production, pasture, and homesite development.

This unit is well suited to irrigated crops. It is limited mainly by droughtiness. In summer, irrigation is needed for the maximum production of most crops. Furrow, border, corrugation, trickle, and sprinkler irrigation systems are suitable. The system used generally is governed by the crop that is grown. For the efficient application and removal of surface irrigation water, leveling is needed on the more sloping parts of the landscape. To prevent overirrigation and the leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. Because the soil is droughty, the applications should be light and frequent. The use of pipe, ditch lining, or drop structures in irrigation ditches reduces water loss and the hazard of erosion.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Leaving crop residue on or near the surface helps to conserve moisture and control erosion.

A tillage pan forms easily if the soil is tilled when wet. Chiseling or subsoiling breaks up the pan. Surface crusting and compaction can be minimized by returning crop residue to the soil.

Solid-set sprinkler irrigation is the best method of controlling frost and providing adequate moisture for tree fruit. Compaction and displacement can be minimized by limiting the use of equipment when the soil is too wet or too dry. A permanent cover crop helps to control runoff and erosion.

Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

This unit is well suited to homesite development. It has few limitations. Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. Because of droughtiness and a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

This unit is suited to the production of ponderosa pine and Douglas fir. Other species that grow on this unit include incense cedar, sugar pine, and Pacific madrone. The understory vegetation includes deerbrush, tall Oregon grape, and western fescue.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 110. The yield at culmination of the mean annual increment is 4,880 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 50,820 board feet per acre (Scribner rule) at 110 years.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 105. The yield at culmination of the mean annual increment is 5,460 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 45,600 board feet per acre (Scribner rule) at 150 years. On the basis of a 50-year curve, the mean site index is 85.

The main limitations affecting timber production are compaction, seedling mortality, and plant competition. Conventional methods of harvesting timber generally are suitable, but the soil may be compacted if it is moist when heavy equipment is used. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Erosion can be controlled by carefully planning the construction and maintenance of logging roads, skid trails, and landings. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

Increased erosion, loss of plant nutrients, and water repellency are likely to result from fires of moderate intensity.

The vegetative site is Douglas Fir-Mixed Pine-Fescue Forest.

10C—Barron coarse sandy loam, 7 to 12 percent slopes. This very deep, somewhat excessively drained soil is on alluvial fans. It formed in alluvium derived dominantly from granitic rock. Elevation is 1,000 to 2,500 feet. The mean annual precipitation is 18 to 35 inches, the mean annual temperature is 50 to 54 degrees F, and the average frost-free period is 120 to 180 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is dark brown coarse sandy loam about 6 inches thick. The subsoil is brown sandy loam about 17 inches thick. The upper 14 inches of the substratum is dark yellowish brown sandy loam. The lower part to a depth of 60 inches is brown sandy loam. The depth to bedrock is 60 inches or more.

Included in this unit are small areas of Clawson and Kubli soils near drainageways and on concave slopes, Central Point soils on the lower parts of the landscape, and Ruch and Shefflein soils. Also included are small areas of Barron soils that have slopes of less than 7 or more than 12 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderately rapid in the Barron soil. Available water capacity is about 6 inches. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is moderate.

This unit is used mainly for irrigated crops, such as alfalfa hay, small grain, tree fruit, and grass-legume hay. It also is used for timber production, pasture, and homesite development.

This unit is well suited to irrigated crops. It is limited mainly by the slope, the hazard of erosion, and droughtiness. In summer, irrigation is needed for the maximum production of most crops. Because of the slope, sprinkler irrigation is the best method of applying water. This method permits an even, controlled application of water, helps to prevent excessive runoff, and minimizes the risk of erosion. To prevent overirrigation and the leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. Because the soil is droughty, the applications should be light and frequent.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Leaving crop residue on or near the surface helps to conserve moisture and control erosion.

A tillage pan forms easily if the soil is tilled when wet. Chiseling or subsoiling breaks up the pan. Surface crusting and compaction can be minimized by returning crop residue to the soil.

Solid-set sprinkler irrigation is the best method of controlling frost and providing adequate moisture for tree fruit. Compaction and displacement can be minimized by limiting the use of equipment when the soil is too wet or too dry. A permanent cover crop helps to control runoff and erosion.

Seedbeds should be prepared on the contour or across the slope where practical. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

This unit is well suited to homesite development. The main limitation is the slope. Erosion is a hazard on the steeper slopes. Only the part of the site that is used for construction should be disturbed. Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. Because of droughtiness and a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

This unit is suited to the production of ponderosa pine and Douglas fir. Other species that grow on this unit include incense cedar, sugar pine, and Pacific madrone. The understory vegetation includes deerbrush, tall Oregon grape, and western fescue.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 110. The yield at culmination of the mean annual increment is 4,880 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 50,820 board feet per acre (Scribner rule) at 110 years.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 105. The yield at culmination of the mean annual increment is 5,460 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 45,600 board feet per acre (Scribner rule) at 150 years. On the basis of a 50-year curve, the mean site index is 85.

The main limitations affecting timber production are compaction, erosion, seedling mortality, and plant competition. Conventional methods of harvesting timber generally are suitable, but the soil may be compacted if it is moist when heavy equipment is used. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Erosion can be controlled by carefully planning the construction and maintenance of logging roads, skid trails, and landings. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

Increased erosion, loss of plant nutrients, and water repellency are likely to result from fires of moderate intensity.

The vegetative site is Douglas Fir-Mixed Pine-Fescue Forest.

11G—Beekman-Colestine gravelly loams, 50 to 80 percent north slopes. This map unit is on hillslopes. Elevation is 1,200 to 4,000 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 55 percent Beekman soil and 30 percent Colestine soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Dubakella, Goolaway, Musty, Pearsoll, Siskiyou, Speaker, and Tethrick soils; Josephine soils on concave slopes; and McMullin soils and Rock outcrop on ridges and convex slopes. Also included are small areas of Beekman and Colestine soils that have slopes of less than 50 or more than 80 percent. Included areas make up about 15 percent of the total acreage.

The Beekman soil is moderately deep and well drained. It formed in colluvium derived dominantly from metamorphic rock. Typically, the surface layer is dark brown gravelly loam about 14 inches thick. The subsoil is grayish brown extremely gravelly loam about 14 inches thick. Bedrock is at a depth of about 28 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is very gravelly loam or is stony.

Permeability is moderate in the Beekman soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

The Colestine soil is moderately deep and well drained. It formed in colluvium derived dominantly from metamorphic rock. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is very dark grayish brown and dark brown gravelly loam about 9 inches thick. The subsoil is brown gravelly clay loam about 25 inches thick. Bedrock is at a depth of about 34 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is very gravelly loam or is stony.

Permeability is moderate in the Colestine soil. Available water capacity is about 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir. Other species that grow on this unit include ponderosa pine, incense cedar, and sugar pine. The understory vegetation includes golden chinkapin, cascade Oregongrape, and deerfoot vanillaleaf.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 120 on the Beekman soil. The yield at culmination of the mean annual increment is 6,900 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 52,440 board feet per acre (Scribner rule) at 120 years. On the basis of a 50-year curve, the mean site index is 85.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 125 on the Colestine soil. The yield at culmination of the mean annual increment is 7,320 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 58,200 board feet per acre (Scribner rule) at 120 years. On the basis of a 50-year curve, the mean site index is 90.

The main limitations affecting timber production are the slope, erosion, plant competition, and seedling mortality. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

The slope restricts the use of wheeled and tracked logging equipment. High-lead or other cable systems are the best methods of logging. If the soils are excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Ripping landings when the soils are dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Road cuts can expose a large amount of fractured bedrock, which limits the response to seeding and mulching. Cut slopes are subject to slumping where the bedrock is highly fractured or where rock layers are parallel to the slopes. Steep yarding paths and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both.

Building logging roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. The large number of rock fragments in the soils also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings.

Increased erosion, loss of plant nutrients, and water repellency are likely to result from fires of moderate intensity.

The vegetative site is Douglas Fir-Chinkapin Forest.

12G—Beekman-Colestine gravelly loams, 50 to 75 percent south slopes. This map unit is on hillslopes. Elevation is 1,200 to 4,000 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 55 percent Beekman soil and 25 percent Colestine soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Dubakella, Goolaway, Musty, Pearsoll, Siskiyou, Speaker, and Tethrick soils; Josephine soils on concave slopes; and McMullin soils and Rock outcrop on ridges and convex slopes. Also included are small areas of Beekman and Colestine soils that have slopes of less than 50 or more than 75 percent. Included areas make up about 20 percent of the total acreage.

The Beekman soil is moderately deep and well drained. It formed in colluvium derived dominantly from metamorphic rock. Typically, the surface layer is dark brown gravelly loam about 14 inches thick. The subsoil is grayish brown extremely gravelly loam about 14 inches thick. Bedrock is at a depth of about 28 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is very gravelly loam or is stony.

Permeability is moderate in the Beekman soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

The Colestine soil is moderately deep and well drained. It formed in colluvium derived dominantly from metamorphic rock. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is very dark grayish brown and dark brown gravelly loam about 9 inches thick. The subsoil is brown gravelly clay loam about 25 inches thick. Bedrock is at a depth of about 34 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is very gravelly loam or is stony.

Permeability is moderate in the Colestine soil. Available water capacity is about 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir. Other species that grow on the unit include ponderosa pine, sugar pine, and California black oak. The understory vegetation includes canyon live oak, deerbrush, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 110 on the Beekman soil. The yield at culmination of the mean annual increment is 5,880 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 48,300 board feet per acre (Scribner rule) at 140 years. On the basis of a 50-year curve, the mean site index is 75.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 115 on the Colestine soil. The yield at culmination of the mean annual increment is 6,360 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 50,700 board feet per acre (Scribner rule) at 130 years. On the basis of a 50-year curve, the mean site index is 85.

The main limitations affecting timber production are the slope, erosion, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

The slope restricts the use of wheeled and tracked logging equipment. High-lead or other cable systems are the best methods of logging. If the soils are excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Ripping landings when the soils are dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Road cuts can expose a large amount of fractured bedrock, which limits the response to seeding and mulching. Cut slopes are subject to slumping where the bedrock is highly fractured or where rock layers are parallel to the slopes. Steep yarding paths and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both.

Building logging roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. The large number of rock fragments in the soils also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced by providing artificial shade for seedlings (fig. 6).

Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

Increased erosion, loss of plant nutrients, and water repellency are likely to result from fires of moderate intensity.

The vegetative site is Douglas Fir-Black Oak Forest.

13C—Bly-Royst complex, 1 to 12 percent slopes. This map unit is on plateaus. Elevation is 3,800 to 4,300 feet. The mean annual precipitation is 15 to 25 inches, the mean annual temperature is 43 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers

Figure 6.—Shade cards used to protect planted seedlings in a clearcut area of Beekman-Colestine gravelly loams, 50 to 75 percent south slopes.

and an understory of grasses, shrubs, and forbs.

This unit is about 55 percent Bly soil and 25 percent Royst soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Greystoke, Merlin, and Kanutchan Variant soils, poorly drained soils near drainageways and on concave slopes, and soils that are similar to the Bly soil but have bedrock within a depth of 60 inches. Also included are small areas of Bly and Royst soils that have slopes of more than 12 percent. Included areas make up about 20 percent of the total acreage.

The Bly soil is very deep and well drained. It formed in residuum and colluvium derived dominantly from andesite and volcanic ash. Typically, the surface is covered with a layer of needles and twigs about 3 inches thick. The surface layer is very dark brown loam about 17 inches thick. The upper 19 inches of the subsoil is dark brown clay loam. The lower 24 inches is dark yellowish brown clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is very gravelly or very cobbly.

Permeability is moderately slow in the Bly soil. Available water capacity is about 9 inches. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

The Royst soil is moderately deep and well drained. It formed in residuum and colluvium derived dominantly from andesite and volcanic ash. Typically, the surface is covered with a layer of needles and twigs about 1 inch thick. The surface layer is dark reddish brown gravelly loam about 11 inches thick. The subsoil is dark reddish brown very cobbly clay loam about 10 inches thick. Weathered bedrock is at a depth of about 21 inches. It becomes harder as depth increases. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is very gravelly or very cobbly.

Permeability is slow in the Royst soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of ponderosa pine. Other species that grow on this unit include an occasional Douglas fir and white fir. The understory vegetation includes antelope bitterbrush, common snowberry, and sedge.

On the basis of a 100-year site curve, the mean site index for ponderosa pine on the Bly soil is 100. The yield at culmination of the mean annual increment is 4,080 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 44,640 board feet per acre (Scribner rule) at 120 years.

On the basis of a 100-year site curve, the mean site index for ponderosa pine on the Royst soil is 80. The yield at culmination of the mean annual increment is 3,060 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 33,750 board feet per acre (Scribner rule) at 150 years.

The main limitations affecting timber production are compaction, erosion, and seedling mortality. Also, the bedrock underlying the Royst soil restricts root growth. As a result, windthrow is a hazard.

Conventional methods of harvesting timber generally are suitable, but the soils may be compacted if they are moist when heavy equipment is used. Puddling can occur when the soils are wet. If the soils are excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Erosion can be controlled by carefully planning the construction and maintenance of logging roads, skid trails, and landings. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Severe frost can damage or kill seedlings. Air drainage may be restricted on this unit. Proper timber harvesting methods can reduce the effect of frost on regeneration. Reforestation can be accomplished by planting ponderosa pine seedlings.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. The large number of rock fragments in the Royst soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings.

The main limitation affecting livestock grazing is compaction. The native vegetation suitable for grazing includes sedge, Idaho fescue, and Wheeler bluegrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soils. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Ponderosa Pine-Fescue.

13E—Bly-Royst complex, 12 to 35 percent slopes. This map unit is on hillslopes. Elevation is 3,800 to 4,300 feet. The mean annual precipitation is 15 to 25 inches, the mean annual temperature is 43 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

This unit is about 55 percent Bly soil and 25 percent Royst soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Greystoke and Merlin soils, poorly drained soils on concave slopes near drainageways, and soils that are similar to the Bly soil but have bedrock within a depth of 60 inches. Also included are small areas of Bly and Royst soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 20 percent of the total acreage.

The Bly soil is very deep and well drained. It formed in colluvium derived dominantly from andesite and volcanic ash. Typically, the surface is covered with a layer of needles and twigs about 3 inches thick. The surface layer is very dark brown loam about 17 inches thick. The upper 19 inches of the subsoil is dark brown clay loam. The lower 24 inches is dark yellowish brown clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is very gravelly, very cobbly, or stony.

Permeability is moderately slow in the Bly soil. Available water capacity is about 9 inches. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

The Royst soil is moderately deep and well drained. It formed in colluvium derived dominantly from andesite and volcanic ash. Typically, the surface is covered with a layer of needles and twigs about 1 inch thick. The surface layer is dark reddish brown gravelly loam about 11 inches thick. The subsoil is dark reddish brown very cobbly clay loam about 10 inches thick. Weathered bedrock is at a depth of about 21 inches. It becomes harder as depth increases. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is very gravelly, very cobbly, or stony.

Permeability is slow in the Royst soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of ponderosa pine. Other species that grow on this unit include an occasional Douglas fir and white fir. The understory vegetation includes antelope bitterbrush, common snowberry, and sedge.

On the basis of a 100-year site curve, the mean site index for ponderosa pine on the Bly soil is 100. The yield at culmination of the mean annual increment is 4,080 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 44,640 board feet per acre (Scribner rule) at 120 years.

On the basis of a 100-year site curve, the mean site index for ponderosa pine on the Royst soil is 80. The yield at culmination of the mean annual increment is 3,060 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 33,750 board feet per acre (Scribner rule) at 150 years.

The main limitations affecting timber production are erosion, compaction, and seedling mortality. Also, the bedrock underlying the Royst soil restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. If the soils are excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soils are moist causes rutting and compaction. Puddling can occur when the soils are wet. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. The large number of rock fragments in the Royst soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. Reforestation can be accomplished by planting ponderosa pine seedlings.

Severe frost can damage or kill seedlings. In the less sloping areas where air drainage may be restricted, proper timber harvesting methods can reduce the effect of frost on regeneration.

The main limitations affecting livestock grazing are compaction and erosion. The native vegetation suitable for grazing includes sedge, Idaho fescue, and Wheeler bluegrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soils. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Ponderosa Pine-Fescue.

14G—Bogus very gravelly loam, 35 to 65 percent north slopes. This very deep, well drained soil is on hillslopes. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Elevation is 3,000 to 4,000 feet. The mean annual precipitation is 25 to 35 inches, the mean annual temperature is 45 to 51 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is black very gravelly loam about 7 inches thick. The next layer is very dark grayish brown very gravelly loam about 8 inches thick. The upper 6 inches of the subsoil is dark brown gravelly clay loam. The lower 44 inches is dark yellowish brown and dark brown clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is stony.

Included in this unit are small areas of McMullin soils and Rock outcrop on ridges and convex slopes, Heppsie soils, and soils that are similar to the Bogus soil but have bedrock within a depth of 60 inches or have more than 35 percent rock fragments. Also included are small areas of Bogus soils that have slopes of less than 35 or more than 65 percent. Included areas make up about 20 percent of the total acreage.

Permeability is slow in the Bogus soil. Available water capacity is about 8 inches. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include incense cedar, sugar pine, and California black oak. The understory vegetation includes tall Oregon grape, common snowberry, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 100. The yield at culmination of the mean annual increment is 5,040 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 39,750 board feet per acre (Scribner rule) at 150 years. On the basis of a 50-year curve, the mean site index is 70.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 90. The yield at culmination of the mean annual increment is 3,400 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 37,960 board feet per acre (Scribner rule) at 130 years.

The main limitations affecting timber production are the slope, erosion, compaction, plant competition, and seedling mortality. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings.

The main limitations affecting livestock grazing are compaction, erosion, and the slope. The native vegetation suitable for grazing includes western fescue, tall trisetum, and mountain brome. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Douglas Fir-Mixed Pine-Sedge Forest.

15C—Bogus-Skookum complex, 1 to 12 percent slopes. This map unit is on old terraces along the Klamath River. Elevation is 3,000 to 4,400 feet. The mean annual precipitation is 18 to 25 inches, the mean annual temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 150 days. The native vegetation on the Bogus soil is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs. That on the Skookum soil is mainly grasses, shrubs, and forbs but includes scattered hardwoods.

This unit is about 50 percent Bogus soil and 30 percent Skookum soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Heppsie soils, Lorella soils and Rock outcrop on convex slopes, Carney soils on concave slopes, and poorly drained soils near drainageways and on concave slopes. Also included are small areas of soils that are similar to the Bogus soil but have bedrock within a depth of 60 inches, soils that are similar to the Skookum soil but have bedrock at a depth of more than 40 inches, and Bogus and Skookum soils that have slopes of more than 12 percent. Included areas make up about 20 percent of the total acreage.

The Bogus soil is very deep and well drained. It formed in residuum and colluvium derived dominantly from andesite, tuff, and breccia. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is black very gravelly loam about 7 inches thick. The next layer is very dark grayish brown very gravelly loam about 8 inches thick. The upper 6 inches of the subsoil is dark brown gravelly clay loam. The lower 44 inches is dark yellowish brown and dark brown clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is loam or is stony.

Permeability is slow in the Bogus soil. Available water capacity is about 8 inches. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

The Skookum soil is moderately deep and well drained. It formed in residuum and colluvium derived dominantly from andesite, tuff, and breccia. Typically, the surface layer is very dark brown very cobbly loam about 3 inches thick. The next layer is very dark grayish brown very cobbly loam about 5 inches thick. The upper 8 inches of the subsoil is very dark grayish brown very cobbly clay loam. The lower 12 inches is dark brown very cobbly and extremely cobbly clay. Bedrock is at a depth of about 28 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Permeability is slow in the Skookum soil. Available water capacity is about 2 inches. The effective rooting depth is 20 to 40 inches. Runoff is slow, and the hazard of water erosion is slight.

This unit is used mainly for livestock grazing or wildlife habitat. The Bogus soil also is used for timber production. A few areas have been cleared and are used for pasture.

The main limitation affecting livestock grazing is compaction. The Skookum soil also is limited by cobbles and stones on the surface and by droughtiness. The vegetation suitable for grazing includes western fescue, mountain brome, and tall trisetum on the Bogus soil and Idaho fescue, bluebunch wheatgrass, and pine bluegrass on the Skookum soil. If the range or understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment. In places the use of ground equipment is limited by the cobbles and stones on the surface of the Skookum soil.

Range seeding is suitable if the site is in poor condition. The main limitations are the very cobbly surface layer and droughtiness of the Skookum soil. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the depth to bedrock in the Skookum soil.

The Bogus soil is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include incense cedar, sugar pine, and California black oak. The understory vegetation includes tall Oregon grape, common snowberry, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 100 on the Bogus soil. The yield at culmination of the mean annual increment is 5,040 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 39,750 board feet per acre (Scribner rule) at 150 years. On the basis of a 50-year curve, the mean site index is 70.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 90 on the Bogus soil. The yield at culmination of the mean annual increment is 3,400 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 37,960 board feet per acre (Scribner rule) at 130 years.

The main limitations affecting timber production on the Bogus soil are compaction, erosion, seedling mortality, and plant competition. Conventional methods of harvesting timber generally are suitable, but the soil may be compacted if it is moist when heavy equipment is used. Puddling can occur when the soil is wet. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Erosion can be controlled by carefully planning the construction and maintenance of logging roads, skid trails, and landings. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. The large number of rock fragments in some areas also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. Reforestation can be accomplished by planting ponderosa pine and Douglas fir seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The vegetative site in areas of the Bogus soil is Douglas Fir-Mixed Pine-Sedge Forest, and the one in areas of the Skookum soil is Droughty Slopes, 20- to 30-inch precipitation zone.

16A—Booth-Kanutchan Variant complex, 0 to 3 percent slopes. This map unit is on plateaus. Elevation is 4,000 to 4,500 feet. The mean annual precipitation is about 18 inches, the mean annual temperature is 43 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly grasses, shrubs, and forbs.

This unit is about 40 percent Booth soil and 35 percent Kanutchan Variant soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Greystoke, Kanutchan, Merlin, Pinehurst, and Royst soils. Also included are small areas of Booth and Kanutchan Variant soils that have slopes of more than 3 percent. Included areas make up about 25 percent of the total acreage.

The Booth soil is moderately deep and well drained. It formed in colluvium derived dominantly from tuff. Typically, the surface layer is dark brown loam about 15 inches thick. The upper 11 inches of the subsoil is brown clay. The lower 9 inches is dark yellowish brown clay. Weathered bedrock is at a depth of about 35 inches. It becomes harder as depth increases. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony or cobbly.

Permeability is slow in the Booth soil. Available water capacity is about 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is slow, and the hazard of water erosion is slight.

The Kanutchan Variant soil is moderately deep and moderately well drained. It is in depressions. It formed in alluvium derived dominantly from tuff and andesite. Typically, the surface layer is dark brown clay about 3 inches thick. The subsoil is dark reddish brown clay about 18 inches thick. Bedrock is at a depth of about 21 inches. The depth to bedrock ranges from 20 to 40 inches.

Permeability is very slow in the Kanutchan Variant soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is ponded, and the hazard of water erosion is slight. The water table is 0.5 foot above the surface from February through May.

This unit is used for livestock grazing and wildlife habitat. The main limitations affecting livestock grazing are compaction and droughtiness in summer and fall. The Kanutchan Variant soil also is limited by the clayey surface layer and wetness in winter and spring. The vegetation suitable for grazing includes Idaho fescue, bluebunch wheatgrass, and Sandberg bluegrass on the Booth soil and Nevada bluegrass and slender wheatgrass on the Kanutchan Variant soil. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Grazing should be delayed until the more desirable forage plants on both soils have achieved enough growth to withstand grazing pressure and until the Kanutchan Variant soil is firm enough to withstand trampling by livestock. The Kanutchan Variant soil generally is drained later in the year than the Booth soil.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment.

Range seeding is suitable if the site is in poor condition. The main limitations are the clayey surface layer and wetness in winter and spring in the Kanutchan Variant soil and the droughtiness of both soils in summer and fall. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

The vegetative site in areas of the Booth soil is Claypan, 14- to 18-inch precipitation zone, and the one in areas of the Kanutchan Variant soil is Intermittent Swale.

17C—Brader-Debenger loams, 1 to 15 percent slopes. This map unit is on knolls and ridges. Elevation is 1,000 to 3,500 feet. The mean annual precipitation is 18 to 35 inches, the mean annual temperature is 50 to 54 degrees F, and the average frost-free period is 150 to 180 days. The native vegetation is mainly hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 60 percent Brader soil and 20 percent Debenger soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Rock outcrop on ridges and convex slopes; Carney, Coker, and Darow soils on concave slopes; Padigan soils near drainageways; Langellain and Ruch soils; and soils that are similar to the Brader soil but have bedrock within a depth of 12 inches. Also included are small areas of Brader and Debenger soils that have slopes of more than 15 percent. Included areas make up about 20 percent of the total acreage.

The Brader soil is shallow and well drained. It formed in colluvium derived dominantly from sandstone. Typically, the surface layer is dark brown loam about 6 inches thick. The subsoil is dark reddish brown loam about 7 inches thick. Weathered bedrock is at a depth of about 13 inches. The depth to bedrock ranges from 12 to 20 inches.

Permeability is moderate in the Brader soil. Available water capacity is about 2 inches. The effective rooting depth is 12 to 20 inches. Runoff is slow or medium, and the hazard of water erosion is slight or moderate.

The Debenger soil is moderately deep and well drained. It formed in colluvium derived dominantly from sandstone. Typically, the surface layer is dark brown loam about 5 inches thick. The next layer is reddish brown loam about 4 inches thick. The subsoil is reddish brown and yellowish red clay loam about 18 inches thick. Weathered bedrock is at a depth of about 27 inches. The depth to bedrock ranges from 20 to 40 inches.

Permeability is moderate in the Debenger soil. Available water capacity is about 5 inches. The effective rooting depth is 20 to 40 inches. Runoff is slow or medium, and the hazard of water erosion is slight or moderate.

This unit is used for livestock grazing, hay and pasture, and homesite development.

The main limitations affecting livestock grazing are compaction, erosion, droughtiness, and the depth to bedrock in the Brader soil. The vegetation suitable for grazing includes Idaho fescue, bluebunch wheatgrass, and pine bluegrass. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock.

Range seeding is suitable if the site is in poor condition. The main limitations are droughtiness and the depth to bedrock in the Brader soil. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the depth to bedrock.

The main limitations affecting the use of this unit for hay and pasture are the depth to bedrock in the Brader soil and droughtiness in both soils. In summer, irrigation is needed for the maximum production of most forage crops. Sprinkler irrigation is the best method of applying water. This method permits an even, controlled application of water, helps to prevent excessive runoff, and minimizes the risk of erosion. Border and contour flood irrigation systems also are suitable in the less sloping areas. For the efficient application and removal of surface irrigation water, land leveling is needed. Because of the depth to bedrock in the Brader soil, however, leveling may expose bedrock. To prevent overirrigation and excessive erosion, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop.

Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soils from erosion. Grazing when the soils are wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

The main limitation affecting homesite development is the depth to bedrock. Cuts needed to provide essentially level building sites can expose bedrock.

This unit is poorly suited to septic tank absorption fields because of the depth to bedrock. The absorption fields can be installed in some areas of included soils that have bedrock at a greater depth. Onsite investigation is needed to locate such areas.

Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. In many areas it may be necessary to haul in topsoil for lawns and gardens. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

The vegetative site in areas of the Brader soil is Loamy Hills, 20- to 35-inch precipitation zone, and the one in areas of the Debenger soil is Loamy Slopes, 18- to 24-inch precipitation zone.

17E—Brader-Debenger loams, 15 to 40 percent slopes. This map unit is on knolls and ridges (fig. 7). Elevation is 1,000 to 3,500 feet. The mean annual precipitation is 18 to 35 inches, the mean annual temperature is 50 to 54 degrees F, and the average frost-free period is 150 to 180 days. The native vegetation is mainly hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 55 percent Brader soil and 20 percent Debenger soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Rock outcrop on ridges and convex slopes, Carney and Darow soils on concave slopes, Padigan soils near drainageways, Heppsie soils on the steeper parts of the landscape, and Langellain and Ruch soils. Also included are small areas of soils that are similar to the Debenger and Brader soils but have more than 35 percent rock fragments, soils that are similar to the Brader soil but have bedrock within a depth of 12 inches, and Brader and Debenger soils that have slopes of less than 15 or more than 40 percent. Included areas make up about 25 percent of the total acreage.

The Brader soil is shallow and well drained. It formed in colluvium derived dominantly from sandstone. Typically, the surface layer is dark brown loam about 6 inches thick. The subsoil is dark reddish brown loam about 7 inches thick. Weathered bedrock is at a depth of about 13 inches. The depth to bedrock ranges from 12 to 20 inches.

Permeability is moderate in the Brader soil. Available water capacity is about 2 inches. The effective rooting depth is 12 to 20 inches. Runoff is medium or rapid, and the hazard of water erosion is moderate or high.

The Debenger soil is moderately deep and well drained. It formed in colluvium derived dominantly from

Figure 7.—An area of Brader-Debenger loams, 15 to 40 percent slopes, on a knoll. Abin silty clay loam, 0 to 3 percent slopes, is on the flood plain in the foreground.

sandstone. Typically, the surface layer is dark brown loam about 5 inches thick. The next layer is reddish brown loam about 4 inches thick. The subsoil is reddish brown and yellowish red clay loam about 18 inches thick. Weathered bedrock is at a depth of about 27 inches. The depth to bedrock ranges from 20 to 40 inches.

Permeability is moderate in the Debenger soil. Available water capacity is about 5 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium or rapid, and the hazard of water erosion is moderate or high.

This unit is used mainly for livestock grazing or homesite development. Some of the less sloping areas are used for hay and pasture.

The main limitations affecting livestock grazing are compaction, erosion, droughtiness, the depth to bedrock in the Brader soil, and the slope. The vegetation suitable for grazing includes Idaho fescue, bluebunch wheatgrass, and pine bluegrass. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock.

Range seeding is suitable if the site is in poor condition. The main limitations are droughtiness, the depth to bedrock in the Brader soil, and the slope. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment. The use of ground equipment and access by livestock are limited on some of the steeper parts of the landscape. Constructing trails or walkways allows livestock to graze in areas where access is limited.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the slope and the depth to bedrock.

The main limitations affecting homesite development are the depth to bedrock and the slope.

This unit is poorly suited to septic tank absorption fields because of the depth to bedrock and the slope. The absorption fields can be installed in some areas of the unit where the soils are deeper over bedrock and are less sloping. Onsite investigation is needed to locate such areas.

The slope limits the use of the steeper parts of this unit for building site development. Cuts needed to provide essentially level building sites can expose bedrock. Erosion is a hazard on the steeper slopes. Only the part of the site that is used for construction should be disturbed. Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. In many areas it may be necessary to haul in topsoil for lawns and gardens. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

The vegetative site in areas of the Brader soil is Loamy Hills, 20- to 35-inch precipitation zone, and the one in areas of the Debenger soil is Loamy Slopes, 18- to 24-inch precipitation zone.

18C—Bybee loam, 1 to 12 percent slopes. This very deep, somewhat poorly drained soil is on plateaus. It formed in residuum and colluvium derived dominantly from andesite, tuff, and breccia. Elevation is 3,600 to 5,500 feet. The mean annual precipitation is 30 to 50 inches, the mean annual temperature is 40 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles and twigs about ½ inch thick. The surface layer is very dark grayish brown loam about 4 inches thick. The next layer is very dark grayish brown clay loam about 6 inches thick. The upper 4 inches of the subsoil is brown clay. The lower 24 inches is light yellowish brown clay. The substratum is light yellowish brown clay about 22 inches thick. The depth to bedrock is 60 inches or more.

Included in this unit are small areas of Pinehurst and Tatouche soils, Kanutchan and Sibannac soils on concave slopes, and Farva soils on convex slopes. Also included are small areas of Bybee soils that have slopes of more than 12 percent. Included areas make up about 20 percent of the total acreage.

Permeability is very slow in the Bybee soil. Available water capacity is about 9 inches. The effective rooting depth is limited by a dense layer of clay at a depth of 10 to 20 inches. Runoff is slow, and the hazard of water erosion is slight. The water table, which is perched above the layer of clay, is at a depth of 1 to 3 feet from December through May.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and white fir. Other species that grow on this unit include incense cedar and ponderosa pine. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and common snowberry.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 100. The yield at culmination of the mean annual increment is 5,040 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 39,750 board feet per acre (Scribner rule) at 150 years. On the basis of a 50-year curve, the mean site index is 75.

The main limitations affecting timber production are compaction, erosion, slumping, seasonal wetness, seedling mortality, and plant competition. Also, the dense layer of clay restricts root growth. As a result, windthrow is a hazard.

Conventional methods of harvesting timber generally are suitable, but the seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or to midwinter, when the soil is frozen. The soil may be compacted if it is moist when heavy equipment is used. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

This unit is subject to severe slumping, especially in areas of road cuts. Road failure and landslides are likely to occur after road construction and clearcutting. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Erosion can be controlled by carefully planning the construction and maintenance of logging roads, skid trails, and landings. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion.

Severe frost can damage or kill seedlings. Air drainage is restricted on this unit. Proper timber harvesting methods can reduce the effect of frost on regeneration. Reforestation can be accomplished by planting seedlings of frost-tolerant species, such as ponderosa pine. The seasonal wetness increases the seedling mortality rate. Also, seedlings planted in the less fertile clayey subsoil grow poorly.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The main limitations affecting livestock grazing are compaction and the seasonal wetness. The native vegetation suitable for grazing includes western fescue, mountain brome, tall trisetum, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Because this unit remains wet for long periods in spring, grazing should be delayed until the soil is firm and the more desirable forage plants have achieved enough growth to withstand grazing pressure. Compaction can be minimized by grazing first in the areas that dry out earliest.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Serviceberry Forest.

19E—Bybee-Tatouche complex, 12 to 35 percent north slopes. This map unit is on hillslopes. Elevation is 3,600 to 5,500 feet. The mean annual precipitation is 30 to 50 inches, the mean annual temperature is 40 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

This unit is about 55 percent Bybee soil and 30 percent Tatouche soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Pinehurst soils, Kanutchan and Sibannac soils on concave slopes, Farva and Woodseye soils on convex slopes, and soils that are similar to the Tatouche soil but have bedrock within a depth of 60 inches. Also included are small areas of Bybee and Tatouche soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 15 percent of the total acreage.

The Bybee soil is very deep and somewhat poorly drained. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Typically, the surface is covered with a layer of needles and twigs about ½ inch thick. The surface layer is very dark grayish brown loam about 4 inches thick. The next layer is very dark grayish brown clay loam about 6 inches thick. The upper 4 inches of the subsoil is brown clay. The lower 24 inches is light yellowish brown clay. The substratum is light yellowish brown clay about 22 inches thick. The depth to bedrock is 60 inches or more.

Permeability is very slow in the Bybee soil. Available water capacity is about 9 inches. The effective rooting depth is limited by a dense layer of clay at a depth of 10 to 20 inches. Runoff is medium, and the hazard of water erosion is moderate. The water table, which is perched above the layer of clay, is at a depth of 1 to 3 feet from December through May.

The Tatouche soil is very deep and well drained. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Typically, the surface is covered with a layer of needles and twigs about 2 inches thick. The surface layer is very dark brown gravelly loam about 11 inches thick. The upper 8 inches of the subsoil is dark brown gravelly clay loam. The lower 41 inches is dark brown clay. The substratum to a depth of 73 inches is strong brown clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is stony or cobbly.

Permeability is moderately slow in the Tatouche soil. Available water capacity is about 8 inches. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and white fir. Other species that grow on this unit include incense cedar and ponderosa pine. The understory vegetation includes creambush oceanspray, cascade Oregongrape, and whitevein shinleaf.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 115 on the Bybee soil. The yield at culmination of the mean annual increment is 6,360 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 50,700 board feet per acre (Scribner rule) at 130 years. On the basis of a 50-year curve, the mean site index is 85.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 125 on the Tatouche soil. The yield at culmination of the mean annual increment is 7,320 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 58,200 board feet per acre (Scribner rule) at 120 years. On the basis of a 50-year curve, the mean site index is 90.

The main limitations affecting timber production are erosion, compaction, plant competition, and seedling mortality. The dense layer of clay in the Bybee soil restricts root growth. As a result, windthrow is a hazard. This soil also is limited by seasonal wetness and slumping.

The seasonal high water table in the Bybee soil restricts the use of equipment to midsummer, when the soil is dry, or to midwinter, when the soil is frozen. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. Using standard wheeled and tracked equipment when the soils are moist causes rutting and compaction. Puddling can occur when the soils are wet. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both.

The Bybee soil is subject to severe slumping. Road failure and landslides are likely to occur after road construction and clearcutting. Slumping can be minimized by constructing logging roads in the less sloping areas, on better suited soils if practical, and by installing properly designed road drainage systems. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

Severe frost can damage or kill seedlings. In the less sloping areas where air drainage may be restricted, proper timber harvesting methods can reduce the effect of frost on regeneration. The seasonal wetness in the Bybee soil increases the seedling mortality rate. Also, seedlings planted in the less fertile clayey subsoil grow poorly.

The main limitations affecting livestock grazing are compaction, erosion, and the seasonal wetness of the Bybee soil. The native vegetation suitable for grazing includes western fescue, mountain brome, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soils. The Bybee soil remains wet for long periods in spring; therefore, grazing should be delayed until the soil is firm and the more desirable forage plants have achieved enough growth to withstand grazing pressure. Compaction can be minimized by grazing first in the areas that dry out earliest.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Oceanspray Forest.

20E—Bybee-Tatouche complex, 12 to 35 percent south slopes. This map unit is on hillslopes. Elevation is 3,600 to 5,500 feet. The mean annual precipitation is 30 to 50 inches, the mean annual temperature is 40 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

This unit is about 55 percent Bybee soil and 30 percent Tatouche soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Pinehurst soils, Kanutchan and Sibannac soils on concave slopes, Farva and Woodseye soils and Rock outcrop on convex slopes, and soils that are similar to the Tatouche soil but have bedrock within a depth of 60 inches. Also included are small areas of Bybee and Tatouche soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 15 percent of the total acreage.

The Bybee soil is very deep and somewhat poorly drained. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Typically, the surface is covered with a layer of needles and twigs about ½ inch thick. The surface layer is very dark grayish brown loam about 4 inches thick. The next layer is very dark grayish brown clay loam about 6 inches thick. The upper 4 inches of the subsoil is brown clay. The lower 24 inches is light yellowish brown clay. The substratum is light yellowish brown clay about 22 inches thick. The depth to bedrock is 60 inches or more.

Permeability is very slow in the Bybee soil. Available water capacity is about 9 inches. The effective rooting depth is limited by a dense layer of clay at a depth of 10 to 20 inches. Runoff is medium, and the hazard of water erosion is moderate. The water table, which is perched above the layer of clay, is at a depth of 1 to 3 feet from December through May.

The Tatouche soil is very deep and well drained. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Typically, the surface is covered with a layer of needles and twigs about 2 inches thick. The surface layer is very dark brown gravelly loam about 11 inches thick. The upper 8 inches of the subsoil is dark brown gravelly clay loam. The lower 41 inches is dark brown clay. The substratum to a depth of 73 inches is strong brown clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is stony or cobbly.

Permeability is moderately slow in the Tatouche soil. Available water capacity is about 8 inches. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and white fir. Other species that grow on this unit include incense cedar and ponderosa pine. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and common snowberry.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 100 on the Bybee soil. The yield at culmination of the mean annual increment is 5,040 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 39,750 board feet per acre (Scribner rule) at 150 years. On the basis of a 50-year curve, the mean site index is 80.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 110 on the Tatouche soil. The yield at culmination of the mean annual increment is 5,880 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 48,300 board feet per acre (Scribner rule) at 140 years. On the basis of a 50-year curve, the mean site index is 85.

The main limitations affecting timber production are erosion, compaction, seedling mortality, and plant competition. The dense layer of clay in the Bybee soil restricts root growth. As a result, windthrow is a hazard. This soil also is limited by seasonal wetness and slumping.

The seasonal high water table in the Bybee soil restricts the use of equipment to midsummer, when the soil is dry, or to midwinter, when the soil is frozen. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. Using standard wheeled and tracked equipment when the soils are moist causes rutting and compaction. Puddling can occur when the soils are wet. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both.

The Bybee soil is subject to severe slumping. Road failure and landslides are likely to occur after road construction and clearcutting. Slumping can be minimized by constructing logging roads in the less sloping areas, on better suited soils if practical, and by installing properly designed road drainage systems. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Severe frost can damage or kill seedlings. In the less sloping areas where air drainage may be restricted, proper timber harvesting methods can reduce the effect of frost on regeneration. The seasonal wetness in the Bybee soil increases the seedling mortality rate. Also, seedlings planted in the less fertile clayey subsoil grow poorly.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The main limitations affecting livestock grazing are compaction, erosion, and the seasonal wetness of the Bybee soil. The native vegetation suitable for grazing includes western fescue, mountain brome, tall trisetum, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soils. The Bybee soil remains wet for long periods in spring; therefore, grazing should be delayed until the soil is firm and the more desirable forage plants have achieved enough growth to withstand grazing pressure. Compaction can be minimized by grazing first in the areas that dry out earliest.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Serviceberry Forest.

21A—Camas sandy loam, 0 to 3 percent slopes. This very deep, excessively drained soil is on flood plains. It formed in alluvium derived from mixed sources. Elevation is 1,000 to 3,000 feet. The mean annual precipitation is 18 to 40 inches, the mean annual temperature is 50 to 54 degrees F, and the average frost-free period is 150 to 180 days. The vegetation in areas that have not been cultivated is mainly hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is dark brown sandy loam about 10 inches thick. The upper 9 inches of the substratum is very dark grayish brown very gravelly loamy sand. The lower part to a depth of 60 inches is very dark grayish brown extremely gravelly coarse sand. In some areas the surface layer is gravelly or cobbly.

Included in this unit are small areas of Riverwash; Cove soils on concave slopes; Central Point, Medford, and Takilma soils on terraces; Abin, Evans, and Newberg soils; and poorly drained soils. Also included are small areas of Camas soils that have slopes of more than 3 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately rapid in the upper part of the Camas soil and very rapid in the lower part. Available water capacity is about 3 inches. The effective rooting depth is 60 inches or more. The substratum can restrict the penetration of roots, however, because of droughtiness. Runoff is slow, and the hazard of water erosion is slight. This soil is occasionally flooded for brief periods from November through May.

This unit is used mainly for hay and pasture. It also is used for cultivated crops, such as small grain, and for homesite development.

This unit is suited to hay and pasture. The main limitations are the flooding and droughtiness. The risk of flooding can be reduced by levees, dikes, and diversions.

In summer, irrigation is needed for the maximum production of most forage crops. Because the rate of water intake is rapid, sprinkler irrigation is the best method of applying water. This method permits an even, controlled application of water, helps to prevent excessive runoff, and minimizes the risk of erosion. To prevent overirrigation and the leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. Because the soil is droughty, the applications should be light and frequent.

Maintaining a protective plant cover in winter reduces the soil loss resulting from flooding. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Leaving crop residue on or near the surface helps to conserve moisture and control erosion.

This unit is poorly suited to homesite development. The main limitations are the flooding and the very rapid permeability in the substratum.

This unit is poorly suited to standard systems of waste disposal because of a poor filtering capacity in the extremely gravelly substratum and the hazard of flooding. Alternative waste disposal systems may function properly on this unit. Suitable included soils are throughout the unit. Onsite investigation is needed to locate such soils. Dikes and channels that have outlets for floodwater can protect buildings and onsite sewage disposal systems from flooding.

In some areas excavation for houses and access roads exposes material that is highly susceptible to soil blowing. Revegetating as soon as possible in disturbed areas around construction sites helps to control soil blowing. Cutbanks are not stable and are subject to slumping. To keep cutbanks from caving in, excavations may require special retainer walls.

Establishing plants in areas where the surface layer has been removed is difficult. Mulching and applying fertilizer help to establish plants in cut areas. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. In many areas it may be necessary to haul in topsoil for lawns and gardens. Because of droughtiness and a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

Roads and streets should be constructed above the expected level of flooding. The risk of flooding has been reduced in some areas by the construction of large dams and reservoirs upstream.

The vegetative site is Loamy Flood Plain, 18- to 30-inch precipitation zone.

22A—Camas gravelly sandy loam, 0 to 3 percent slopes. This very deep, excessively drained soil is on flood plains. It formed in alluvium derived from mixed sources. Elevation is 1,000 to 3,000 feet. The mean annual precipitation is 18 to 40 inches, the mean annual temperature is 50 to 54 degrees F, and the average frost-free period is 150 to 180 days. The vegetation in areas that have not been cultivated is mainly hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is dark brown gravelly sandy loam about 10 inches thick. The upper 9 inches of the substratum is very dark grayish brown very gravelly loamy sand. The lower part to a depth of 60 inches is very dark grayish brown extremely gravelly coarse sand. In some areas the surface layer is very gravelly or cobbly.

Included in this unit are small areas of Riverwash; Cove soils on concave slopes; Central Point, Medford, and Takilma soils on terraces; Abin, Evans, and Newberg soils; and poorly drained soils. Also included are small areas of Camas soils that have slopes of more than 3 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately rapid in the upper part of the Camas soil and very rapid in the lower part. Available water capacity is about 3 inches. The effective rooting depth is 60 inches or more. The substratum can restrict the penetration of roots, however, because of droughtiness. Runoff is slow, and the hazard of water erosion is slight. This soil is occasionally flooded for brief periods from November through May.

This unit is used mainly for hay and pasture. It also is used for cultivated crops, such as small grain, and for homesite development.

This unit is suited to hay and pasture. The main limitations are the flooding, droughtiness, and gravel on the surface, which may limit the use of equipment. The risk of flooding can be reduced by levees, dikes, and diversions.

In summer, irrigation is needed for the maximum production of most forage crops. Because the rate of water intake is rapid, sprinkler irrigation is the best method of applying water. This method permits an even, controlled application of water, helps to prevent excessive runoff, and minimizes the risk of erosion. To prevent overirrigation and the leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. Because the soil is droughty, the applications should be light and frequent.

Maintaining a protective plant cover in winter reduces the soil loss resulting from flooding. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Leaving crop residue on or near the surface helps to conserve moisture and control erosion.

This unit is poorly suited to homesite development. The main limitations are the flooding and the very rapid permeability in the substratum.

This unit is poorly suited to standard systems of waste disposal because of a poor filtering capacity in the extremely gravelly substratum and the hazard of flooding. Alternative waste disposal systems may function properly on this unit. Suitable included soils are throughout the unit. Onsite investigation is needed to locate such soils. Dikes and channels that have outlets for floodwater can protect buildings and onsite sewage disposal systems from flooding.

In some areas excavation for houses and access roads exposes material that is highly susceptible to soil blowing. Revegetating as soon as possible in disturbed areas around construction sites helps to control soil blowing. Cutbanks are not stable and are subject to slumping. To keep cutbanks from caving in, excavations may require special retainer walls.

Establishing plants is difficult in areas where the surface layer has been removed and the extremely gravelly substratum exposed. Mulching and applying fertilizer help to establish plants in cut areas. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. In many areas it may be necessary to haul in topsoil for lawns and gardens. Because of droughtiness and a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

Roads and streets should be constructed above the expected level of flooding. The risk of flooding has been reduced in some areas by the construction of large dams and reservoirs upstream.

The vegetative site is Loamy Flood Plain, 18- to 30-inch precipitation zone.

23A—Camas-Newberg-Evans complex, 0 to 3 percent slopes. This map unit is on flood plains. Elevation is 1,000 to 3,000 feet. The mean annual precipitation is 18 to 40 inches, the mean annual temperature is 50 to 54 degrees F, and the average frost-free period is 150 to 180 days. The native vegetation is mainly hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 40 percent Camas soil, 30 percent Newberg soil, and 20 percent Evans soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Riverwash; Cove soils on concave slopes; Central Point, Medford, and Takilma soils on terraces; Abin soils; and poorly drained soils. Also included are small areas of Camas, Newberg, and Evans soils that have slopes of more than 3 percent. Included areas make up about 10 percent of the total acreage.

The Camas soil is very deep and excessively drained. It formed in alluvium derived from mixed sources. Typically, the surface layer is dark brown gravelly sandy loam about 10 inches thick. The upper 9 inches of the substratum is very dark grayish brown very gravelly loamy sand. The lower part to a depth of 60 inches is very dark grayish brown extremely gravelly coarse sand. In some areas the surface layer is very gravelly or cobbly.

Permeability is moderately rapid in the upper part of the Camas soil and very rapid in the lower part. Available water capacity is about 3 inches. The effective rooting depth is 60 inches or more. The substratum can restrict the penetration of roots, however, because of droughtiness. Runoff is slow, and the hazard of water erosion is slight. This soil is occasionally flooded for brief periods from November through May. In some areas the water table is within a depth of 60 inches.

The Newberg soil is very deep and somewhat excessively drained. It formed in alluvium derived from mixed sources. Typically, the surface layer is very dark grayish brown fine sandy loam about 17 inches thick. The upper 13 inches of the substratum is dark brown sandy loam. The next 12 inches is dark brown fine sand. The lower part to a depth of 60 inches is dark grayish brown loamy sand. In some areas the surface layer is gravelly or cobbly.

Permeability is moderately rapid in the upper part of the Newberg soil and rapid in the lower part. Available water capacity is about 8 inches. The effective rooting depth is 60 inches or more. The substratum can restrict the penetration of roots, however, because of droughtiness. Runoff is slow, and the hazard of water erosion is slight. This soil is occasionally flooded for brief periods from December through March. In some areas the water table is within a depth of 60 inches.

The Evans soil is very deep and well drained. It formed in alluvium derived from mixed sources. Typically, the surface layer is very dark brown loam about 38 inches thick. The substratum to a depth of 60 inches is dark brown loam. In some areas the surface layer is gravelly or cobbly.

Permeability is moderate in the Evans soil. Available water capacity is about 11 inches. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. This soil is occasionally flooded for brief periods from December through March. In some areas the water table is within a depth of 60 inches.

This unit is used mainly for wildlife habitat or for hay and pasture. It also is used for homesite development.

The main limitations in the areas used for hay and pasture are the flooding, droughtiness, and gravel on the surface, which may limit the use of equipment. The risk of flooding can be reduced by levees, dikes, and diversions.

In summer, irrigation is needed for the maximum production of most forage crops. Because of a moderately rapid rate of water intake in the Camas and

Newberg soils, sprinkler irrigation is the best method of applying water. This method permits an even, controlled application of water, helps to prevent excessive runoff, and minimizes the risk of erosion. To prevent overirrigation and the leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. Because the soils are droughty, the applications should be light and frequent.

Maintaining a protective plant cover in winter reduces the soil loss resulting from flooding. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soils from erosion. Grazing when the soils are wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

Returning all crop residue to the soils and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Leaving crop residue on or near the surface helps to conserve moisture and control erosion.

This unit is poorly suited to homesite development. The main limitations are the flooding and the rapid or very rapid permeability in the substratum of the Camas and Newberg soils.

This unit is poorly suited to standard systems of waste disposal because of a poor filtering capacity in the substratum of the Camas and Newberg soils and the hazard of flooding. Alternative waste disposal systems may function properly on this unit. Suitable included soils are throughout the unit. Onsite investigation is needed to locate such soils. Dikes and channels that have outlets for floodwater can protect buildings and onsite sewage disposal systems from flooding.

In some areas excavation for houses and access roads exposes material that is highly susceptible to soil blowing. Revegetating as soon as possible in disturbed areas around construction sites helps to control soil blowing. Cutbanks are not stable and are subject to slumping. To keep cutbanks from caving in, excavations may require special retainer walls.

Establishing plants is difficult in areas where the surface layer has been removed. Mulching and applying fertilizer help to establish plants in cut areas. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. In many areas it may be necessary to haul in topsoil for lawns and gardens. Because of droughtiness and a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

Roads and streets should be constructed above the expected level of flooding. The risk of flooding has been reduced in some areas by the construction of large dams and reservoirs upstream.

The vegetative site is Loamy Flood Plain, 18- to 30-inch precipitation zone.

24C—Campfour-Paragon complex, 1 to 12 percent slopes. This map unit is on plateaus. Elevation is 3,000 to 4,400 feet. The mean annual precipitation is 20 to 25 inches, the mean annual temperature is 45 to 51 degrees F, and the average frost-free period is 100 to 130 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 45 percent Campfour soil and 30 percent Paragon soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Rock outcrop; Carney, Randcore, Shoat, and Skookum soils; and soils that are similar to the Paragon soil but have more than 35 percent hard rock fragments or have bedrock at a depth of more than 40 inches. Also included are small areas of Campfour and Paragon soils that have slopes of more than 12 percent. Included areas make up about 25 percent of the total acreage.

The Campfour soil is very deep and well drained. It formed in residuum and colluvium derived dominantly from andesite. Typically, the surface is covered with a layer of needles and twigs about 1 inch thick. The surface layer is dark reddish brown loam about 5 inches thick. The next layer is dark reddish brown loam about 16 inches thick. The upper 29 inches of the subsoil is dark reddish brown clay loam. The lower 10 inches is dark reddish brown gravelly clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is stony.

Permeability is moderately slow in the Campfour soil. Available water capacity is about 8 inches. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

The Paragon soil is moderately deep and well drained. It formed in residuum and colluvium derived dominantly from andesite. Typically, the surface is covered with a layer of needles and twigs about 1 inch thick. The surface layer is dark reddish brown cobbly loam about 3 inches thick. The next 10 inches also is dark reddish brown cobbly loam. The subsoil is dark reddish brown gravelly clay loam about 12 inches thick. Weathered bedrock is at a depth of about 25 inches.

The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony or very cobbly.

Permeability is moderately slow in the Paragon soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include incense cedar and California black oak. The understory vegetation includes tall Oregon grape, common snowberry, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 110 on the Campfour soil. The yield at culmination of the mean annual increment is 5,880 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 48,300 board feet per acre (Scribner rule) at 140 years. On the basis of a 50-year curve, the mean site index is 85.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 95 on the Campfour soil. The yield at culmination of the mean annual increment is 3,760 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 43,160 board feet per acre (Scribner rule) at 130 years.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 85 on the Paragon soil. The yield at culmination of the mean annual increment is 4,480 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years and 27,520 board feet per acre (Scribner rule) at 160 years. On the basis of a 50-year curve, the mean site index is 60.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 80 on the Paragon soil. The yield at culmination of the mean annual increment is 2,670 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 33,750 board feet per acre (Scribner rule) at 150 years.

The main limitations affecting timber production are compaction, erosion, and seedling mortality. Also, the bedrock underlying the Paragon soil restricts root growth. As a result, windthrow is a hazard.

Conventional methods of harvesting timber generally are suitable, but the soils may be compacted if they are moist when heavy equipment is used. Puddling can occur when the soils are wet. If the soils are excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Erosion can be controlled by carefully planning the construction and maintenance of logging roads, skid trails, and landings. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. The large number of rock fragments in the Paragon soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. Reforestation can be accomplished by planting ponderosa pine and Douglas fir seedlings.

Severe frost can damage or kill seedlings. Air drainage may be restricted on this unit. Proper timber harvesting methods can reduce the effect of frost on regeneration.

The main limitation affecting livestock grazing is compaction. The native vegetation suitable for grazing includes western fescue, tall trisetum, and mountain brome on the Campfour soil and Idaho fescue and bluegrass on the Paragon soil. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soils. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site in areas of the Campfour soil is Douglas Fir-Mixed Pine-Sedge Forest, and the one in areas of the Paragon soil is Loamy Slopes, 18- to 24-inch precipitation zone.

24E—Campfour-Paragon complex, 12 to 35 percent slopes. This map unit is on hillslopes. It is commonly on south-facing slopes. Elevation is 3,000 to 4,400 feet. The mean annual precipitation is 20 to 25 inches, the mean annual temperature is 45 to 51 degrees F, and the average frost-free period is 100 to 130 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 45 percent Campfour soil and 30 percent Paragon soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Rock outcrop; Carney, Randcore, Shoat, and Skookum soils; and soils that are similar to the Paragon soil but have more than 35 percent hard rock fragments or have bedrock at a depth of more than 40 inches. Also included are small areas of Campfour and Paragon soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 25 percent of the total acreage.

The Campfour soil is very deep and well drained. It formed in colluvium derived dominantly from andesite. Typically, the surface is covered with a layer of needles and twigs about 1 inch thick. The surface layer is dark reddish brown loam about 5 inches thick. The next layer is dark reddish brown loam about 16 inches thick. The upper 29 inches of the subsoil is dark reddish brown clay loam. The lower 10 inches is dark reddish brown gravelly clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is stony.

Permeability is moderately slow in the Campfour soil. Available water capacity is about 8 inches. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

The Paragon soil is moderately deep and well drained. It formed in colluvium derived dominantly from andesite. Typically, the surface is covered with a layer of needles and twigs about 1 inch thick. The surface layer is dark reddish brown cobbly loam about 3 inches thick. The next 10 inches also is dark reddish brown cobbly loam. The subsoil is dark reddish brown gravelly clay loam about 12 inches thick. Weathered bedrock is at a depth of about 25 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony or very cobbly.

Permeability is moderately slow in the Paragon soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include incense cedar and California black oak. The understory vegetation includes tall Oregon grape, common snowberry, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 110 on the Campfour soil. The yield at culmination of the mean annual increment is 5,880 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 48,300 board feet per acre (Scribner rule) at 140 years. On the basis of a 50-year curve, the mean site index is 85.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 95 on the Campfour soil. The yield at culmination of the mean annual increment is 3,760 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 43,160 board feet per acre (Scribner rule) at 130 years.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 85 on the Paragon soil. The yield at culmination of the mean annual increment is 4,480 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years and 27,520 board feet per acre (Scribner rule) at 160 years. On the basis of a 50-year curve, the mean site index is 60.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 80 on the Paragon soil. The yield at culmination of the mean annual increment is 2,670 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 33,750 board feet per acre (Scribner rule) at 150 years.

The main limitations affecting timber production are erosion, compaction, and seedling mortality. Also, the bedrock underlying the Paragon soil restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. If the soils are excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soils are moist causes rutting and compaction. Puddling can occur when the soils are wet. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding

paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. The large number of rock fragments in the Paragon soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. Reforestation can be accomplished by planting ponderosa pine and Douglas fir seedlings.

Severe frost can damage or kill seedlings in the less sloping areas where air drainage may be restricted. Proper timber harvesting methods can reduce the effect of frost on regeneration.

The main limitations affecting livestock grazing are compaction and erosion. The native vegetation suitable for grazing includes western fescue, tall trisetum, and mountain brome on the Campfour soil and Idaho fescue and bluegrass on the Paragon soil. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soils. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site in areas of the Campfour soil is Douglas Fir-Mixed Pine-Sedge Forest, and the one in areas of the Paragon soil is Loamy Slopes, 18- to 24-inch precipitation zone.

25G—Caris-Offenbacher gravelly loams, 50 to 80 percent north slopes. This map unit is on hillslopes. Elevation is 1,000 to 4,000 feet. The mean annual precipitation is 25 to 40 inches, the mean annual temperature is 46 to 54 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 60 percent Caris soil and 30 percent Offenbacher soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Tallowbox, Vannoy, and Voorhies soils; small areas of McMullin soils and Rock outcrop on ridges and convex slopes; and, on concave slopes, soils that are similar to the Caris and Offenbacher soils but have bedrock at a depth of more than 40 inches. Also included are small areas of Caris and Offenbacher soils that have slopes of less than 50 or more than 80 percent. Included areas make up about 10 percent of the total acreage.

The Caris soil is moderately deep and well drained. It formed in colluvium derived dominantly from metamorphic rock. Typically, the surface is covered with a layer of needles and twigs about 1 inch thick. The surface layer is very dark grayish brown gravelly loam about 7 inches thick. The upper 13 inches of the subsoil is dark yellowish brown very gravelly clay loam. The lower 11 inches is dark yellowish brown extremely gravelly loam. Bedrock is at a depth of about 31 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is very gravelly loam or is stony.

Permeability is moderate in the Caris soil. Available water capacity is about 2 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

The Offenbacher soil is moderately deep and well drained. It formed in colluvium derived dominantly from metamorphic rock. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is dark grayish brown and dark brown gravelly loam about 9 inches thick. The subsoil is reddish brown and yellowish red loam about 25 inches thick. Bedrock is at a depth of about 34 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is very gravelly loam or is stony.

Permeability is moderate in the Offenbacher soil. Available water capacity is about 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir. Other species that grow on this unit include incense cedar, ponderosa pine, and Pacific madrone. The understory vegetation includes oceanspray, common snowberry, and tall Oregon grape.

On the basis of a 100-year site curve, the mean site

index for Douglas fir is 105 on the Caris soil. The yield at culmination of the mean annual increment is 5,460 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 45,600 board feet per acre (Scribner rule) at 150 years. On the basis of a 50-year curve, the mean site index is 70.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 110 on the Offenbacher soil. The yield at culmination of the mean annual increment is 5,880 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 48,300 board feet per acre (Scribner rule) at 140 years. On the basis of a 50-year curve, the mean site index is 75.

The main limitations affecting timber production are the slope, erosion, plant competition, and seedling mortality. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

The slope restricts the use of wheeled and tracked logging equipment. High-lead or other cable systems are the best methods of logging. If the soils are excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Ripping landings when the soils are dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Road cuts can expose a large amount of fractured bedrock, which limits the response to seeding and mulching. Cut slopes are subject to slumping where the bedrock is highly fractured or where rock layers are parallel to the slopes. Steep yarding paths and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both.

Building logging roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. The large number of rock fragments in the soils also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings.

Increased erosion, loss of plant nutrients, and water repellency are likely to result from fires of moderate intensity.

The vegetative site is Douglas Fir Forest.

26G—Caris-Offenbacher gravelly loams, 50 to 75 percent south slopes. This map unit is on hillslopes. Elevation is 1,000 to 4,000 feet. The mean annual precipitation is 25 to 40 inches, the mean annual temperature is 46 to 54 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 60 percent Caris soil and 20 percent Offenbacher soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Tallowbox, Vannoy, and Voorhies soils; McMullin soils and Rock outcrop on ridges and convex slopes; and, on concave slopes, soils that are similar to the Caris and Offenbacher soils but have bedrock at a depth of more than 40 inches. Also included are small areas of Caris and Offenbacher soils that have slopes of less than 50 percent and more than 75 percent. Included areas make up about 20 percent of the total acreage.

The Caris soil is moderately deep and well drained. It formed in colluvium derived dominantly from metamorphic rock. Typically, the surface is covered with a layer of needles and twigs about 1 inch thick. The surface layer is very dark grayish brown gravelly loam about 7 inches thick. The upper 13 inches of the subsoil is dark yellowish brown very gravelly clay loam. The lower 11 inches is dark yellowish brown extremely gravelly loam. Bedrock is at a depth of about 31 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is very gravelly loam or is stony.

Permeability is moderate in the Caris soil. Available water capacity is about 2 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

The Offenbacher soil is moderately deep and well drained. It formed in colluvium derived dominantly from metamorphic rock. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is dark grayish brown and dark brown gravelly loam about 9 inches thick. The subsoil is reddish brown and yellowish red loam about 25 inches thick. Bedrock is at a depth of about 34 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is very gravelly loam or is stony.

Permeability is moderate in the Offenbacher soil. Available water capacity is about 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include incense cedar, California black oak, and Pacific madrone. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and California fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 100 on the Caris soil. The yield at culmination of the mean annual increment is 5,040 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 39,750 board feet per acre (Scribner rule) at 150 years. On the basis of a 50-year curve, the mean site index is 65.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 105 on the Offenbacher soil. The yield at culmination of the mean annual increment is 5,460 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 45,600 board feet per acre (Scribner rule) at 150 years. On the basis of a 50-year curve, the mean site index is 70.

The main limitations affecting timber production are the slope, erosion, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

The slope restricts the use of wheeled and tracked logging equipment. High-lead or other cable systems are the best methods of logging. If the soils are excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Ripping landings when the soils are dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Road cuts can expose a large amount of fractured bedrock, which limits the response to seeding and mulching. Cut slopes are subject to slumping where the bedrock is highly fractured or where rock layers are parallel to the slopes. Steep yarding paths and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both.

Building logging roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. The large number of rock fragments in the soils also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced by providing artificial shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

Increased erosion, loss of plant nutrients, and water repellency are likely to result from fires of moderate intensity.

The vegetative site is Pine-Douglas Fir-Fescue.

27B—Carney clay, 1 to 5 percent slopes. This moderately deep, moderately well drained soil is on alluvial fans. It formed in alluvium derived dominantly from tuff and breccia. Elevation is 1,200 to 4,000 feet. The mean annual precipitation is 18 to 30 inches, the mean annual temperature is 48 to 54 degrees F, and the average frost-free period is 150 to 180 days. The native vegetation is mainly hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is dark brown clay about 6 inches thick. The next layer also is dark brown clay about 6 inches thick. The subsoil is dark brown clay about 23 inches thick. Weathered bedrock is at a depth of about 35 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is cobbly or stony.

Included in this unit are small areas of Coker and Phoenix soils on concave slopes, Cove and Padigan soils on concave slopes near drainageways, Brader and Debenger soils on ridges and convex slopes, and Darow and Manita soils. Also included are small areas of soils that are similar to the Carney soil but have bedrock at a depth of more than 40 inches and Carney soils that have slopes of more than 5 percent. Included areas make up about 20 percent of the total acreage.

Permeability is very slow in the Carney soil. Available water capacity is about 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is slow, and the hazard of water erosion is slight. The water table fluctuates between depths of 3.0 and 3.5 feet from December through April.

This unit is used mainly for hay and pasture or for tree fruit. It also is used for homesite development and livestock grazing.

This unit is suited to irrigated crops. It is limited mainly by the high content of clay, a slow rate of water intake, and droughtiness. In summer, irrigation is needed for the maximum production of most crops. Sprinkler and trickle irrigation systems are the best methods of applying water. These systems permit an even, controlled application of water, help to prevent excessive runoff, and minimize the risk of erosion. Border and contour flood irrigation systems also are suitable. For the efficient application and removal of surface irrigation water, land leveling is needed. Because of the very slow permeability, water applications should be regulated so that the water does not stand on the surface and damage the crop. Land smoothing and open ditches can reduce surface wetness. The use of pipe, ditch lining, or drop structures in irrigation ditches reduces water loss and the hazard of erosion.

Solid-set sprinkler irrigation is the best method of controlling frost and providing adequate moisture for tree fruit. Compaction can be minimized by limiting the use of equipment when the soil is wet. A permanent cover crop helps to control runoff and erosion.

This unit is well suited to permanent pasture. The high content of clay severely limits tillage and root growth. Deep cracks form as the soil dries in summer. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

The main limitations affecting homesite development are the very slow permeability, a high shrink-swell potential, the depth to bedrock, and low strength.

This unit is poorly suited to standard systems of waste disposal because of the very slow permeability and the depth to bedrock. Alternative waste disposal systems may function properly on this unit. Suitable included soils are throughout the unit. Onsite investigation is needed to locate such soils.

If buildings are constructed on this unit, properly designing foundations and footings, diverting runoff away from the buildings, and backfilling with material that has a low shrink-swell potential help to prevent the structural damage caused by shrinking and swelling. Properly designing buildings and roads helps to offset the limited ability of the soil to support a load. Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. In many areas it may be necessary to haul in topsoil for lawns and gardens. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

The main limitations affecting livestock grazing are compaction, the clayey surface layer, and droughtiness. The vegetation suitable for grazing includes Idaho fescue, bluebunch wheatgrass, and prairie junegrass. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment.

Range seeding is suitable if the site is in poor condition. The main limitations are the clayey surface layer and droughtiness. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the depth to bedrock.

The vegetative site is Droughty Fan, 18- to 26-inch precipitation zone.

27D—Carney clay, 5 to 20 percent slopes. This moderately deep, moderately well drained soil is on alluvial fans and hillslopes. It formed in alluvium and colluvium derived dominantly from tuff and breccia. Elevation is 1,200 to 4,000 feet. The mean annual precipitation is 18 to 30 inches, the mean annual temperature is 48 to 54 degrees F, and the average frost-free period is 150 to 180 days. The native vegetation is mainly hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is dark brown clay about 6 inches thick. The next layer also is dark brown clay about 6 inches thick. The subsoil is dark brown clay about 23 inches thick. Weathered bedrock is at a depth of about 35 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is cobbly or stony.

Included in this unit are small areas of Coker and Phoenix soils on concave slopes; Cove and Padigan soils on concave slopes near drainageways; and Rock outcrop and Brader, Debenger, Darow, and Manita soils. Also included are small areas of soils that are similar to the Carney soil but have bedrock at a depth of less than 20 or more than 40 inches and Carney soils that have slopes of less than 5 or more than 20 percent. Included areas make up about 20 percent of the total acreage.

Permeability is very slow in the Carney soil. Available water capacity is about 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is slow or medium, and the hazard of water erosion is slight or moderate. The water table fluctuates between depths of 3.0 and 3.5 feet from December through April.

This unit is used mainly for hay and pasture or for tree fruit. It also is used for homesite development and livestock grazing.

This unit is suited to irrigated crops. It is limited mainly by the high content of clay, a slow rate of water intake, the slope, and droughtiness. In summer, irrigation is needed for the maximum production of most crops. Because of the slope, sprinkler and trickle irrigation systems are suitable methods of applying water. These systems permit an even, controlled application of water, help to prevent excessive runoff, and minimize the risk of erosion. To prevent overirrigation and excessive erosion, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop.

Solid-set sprinkler irrigation is the best method of controlling frost and providing adequate moisture for tree fruit. Compaction can be minimized by limiting the use of equipment when the soil is wet. A permanent cover crop helps to control runoff and erosion.

This unit is well suited to permanent pasture. The high content of clay severely limits tillage and root growth. Deep cracks form as the soil dries in summer. Seedbeds should be prepared on the contour or across the slope where practical. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

The main limitations affecting homesite development are the very slow permeability, a high shrink-swell potential, the depth to bedrock, the slope, and low strength.

This unit is poorly suited to standard systems of waste disposal because of the very slow permeability and the depth to bedrock. Alternative waste disposal systems may function properly on this unit. Suitable included soils are throughout the unit. Onsite investigation is needed to locate such soils.

If buildings are constructed on this unit, properly designing foundations and footings, diverting runoff away from the buildings, and backfilling with material that has a low shrink-swell potential help to prevent the structural damage caused by shrinking and swelling. Properly designing buildings and roads helps to offset the limited ability of the soil to support a load.

Erosion is a hazard on the steeper slopes. Only the part of the site that is used for construction should be disturbed. Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. In many areas it may be necessary to haul in topsoil for lawns and gardens. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

The main limitations affecting livestock grazing are compaction, erosion, the clayey surface layer, and droughtiness. The vegetation suitable for grazing includes Idaho fescue, bluebunch wheatgrass, and prairie junegrass. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Range seeding is suitable if the site is in poor condition. The main limitations are the clayey surface layer and droughtiness. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the slope and the depth to bedrock.

The vegetative site is Droughty Fan, 18- to 26-inch precipitation zone.

28D—Carney cobbly clay, 5 to 20 percent slopes. This moderately deep, moderately well drained soil is on alluvial fans and hillslopes. It formed in alluvium and colluvium derived dominantly from tuff and breccia. Elevation is 1,200 to 4,000 feet. The mean annual precipitation is 18 to 30 inches, the mean annual temperature is 48 to 54 degrees F, and the average frost-free period is 150 to 180 days. The native vegetation is mainly hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is dark brown cobbly clay about 6 inches thick. The next layer is dark brown clay about 6 inches thick. The subsoil also is dark brown clay. It is about 23 inches thick. Weathered bedrock is at a depth of about 35 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Included in this unit are small areas of Coker and Phoenix soils on concave slopes; Cove and Padigan soils on concave slopes near drainageways; Rock outcrop; Brader, Debenger, and Darow soils; and soils that are similar to the Carney soil but have bedrock at a depth of less than 20 or more than 40 inches. Also included are small areas of Carney soils that have slopes of less than 5 or more than 20 percent. Included areas make up about 20 percent of the total acreage.

Permeability is very slow in the Carney soil. Available water capacity is about 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is slow or medium, and the hazard of water erosion is slight or moderate. The water table fluctuates between depths of 3.0 and 3.5 feet from December through April.

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

The main limitations affecting livestock grazing are compaction, erosion, the surface layer of cobbly clay, and droughtiness. The vegetation suitable for grazing includes Idaho fescue, bluebunch wheatgrass, and prairie junegrass. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Range seeding is suitable if the site is in poor condition. The main limitations are the surface layer of cobbly clay and droughtiness. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment. In places the use of ground equipment is limited by the cobbles on the surface.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the slope and the depth to bedrock.

This unit is suited to permanent pasture. It is limited mainly by the high content of clay, a slow rate of water intake, the cobbly surface layer, and the slope. The high content of clay and cobbles in the surface layer severely limits tillage and root growth. Deep cracks form as the soil dries in summer.

In summer, irrigation is needed for the maximum production of most forage crops. Because of the slope, sprinkler irrigation is the best method of applying water. This method permits an even, controlled application of water, helps to prevent excessive runoff, and minimizes the risk of erosion. To prevent overirrigation and excessive erosion, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop.

Seedbeds should be prepared on the contour or across the slope where practical. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

The main limitations affecting homesite development are the very slow permeability, a high shrink-swell potential, the depth to bedrock, low strength, and the slope.

This unit is poorly suited to standard systems of waste disposal because of the very slow permeability and the depth to bedrock. Alternative waste disposal systems may function properly on this unit. Suitable included soils are throughout the unit. Onsite investigation is needed to locate such soils.

If buildings are constructed on this unit, properly designing foundations and footings, diverting runoff away from the buildings, and backfilling with material that has a low shrink-swell potential help to prevent the structural damage caused by shrinking and swelling.

Properly designing buildings and roads helps to offset the limited ability of the soil to support a load.

Erosion is a hazard on the steeper slopes. Only the part of the site that is used for construction should be disturbed. Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. Removal of cobbles in disturbed areas is needed for the best results in landscaping, particularly in areas used for lawns. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. In many areas it may be necessary to haul in topsoil for lawns and gardens. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

The vegetative site is Droughty Fan, 18- to 26-inch precipitation zone.

28E—Carney cobbly clay, 20 to 35 percent slopes. This moderately deep, moderately well drained soil is on alluvial fans and hillslopes. It formed in alluvium and colluvium derived dominantly from tuff and breccia. Elevation is 1,200 to 4,000 feet. The mean annual precipitation is 18 to 30 inches, the mean annual temperature is 48 to 54 degrees F, and the average frost-free period is 150 to 180 days. The native vegetation is mainly grasses, shrubs, and forbs.

Typically, the surface layer is dark brown cobbly clay about 6 inches thick. The next layer is dark brown clay about 6 inches thick. The subsoil also is dark brown clay. It is about 23 inches thick. Weathered bedrock is at a depth of about 35 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Included in this unit are small areas of Coker and Phoenix soils on concave slopes; Cove and Padigan soils on concave slopes near drainageways; Rock outcrop; and Brader, Debenger, Darow, and Manita soils. Also included are small areas of Heppsie soils on the steeper parts of the landscape, soils that are similar to the Carney soil but have bedrock at a depth of less than 20 or more than 40 inches, and Carney soils that have slopes of less than 20 or more than 35 percent. Included areas make up about 20 percent of the total acreage.

Permeability is very slow in the Carney soil. Available water capacity is about 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate. The water table fluctuates between depths of 3.0 and 3.5 feet from December through April.

This unit is used for livestock grazing or homesite development.

The main limitations affecting livestock grazing are compaction, erosion, the surface layer of cobbly clay, droughtiness, and the slope. The vegetation suitable for grazing includes Idaho fescue, bluebunch wheatgrass, and Lemmon needlegrass. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Range seeding is suitable if the site is in poor condition. The main limitations are the surface layer of cobbly clay, the slope, and droughtiness. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment. In places the use of ground equipment and access by livestock are limited by the cobbles on the surface and the slope.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the slope and the depth to bedrock.

The main limitations affecting homesite development are the very slow permeability, a high shrink-swell potential, the depth to bedrock, the slope, and low strength.

This unit is poorly suited to standard systems of waste disposal because of the very slow permeability, the depth to bedrock, and the slope. Alternative waste disposal systems may function properly on this unit. Suitable included soils are throughout the unit. Onsite investigation is needed to locate such soils.

The slope limits the use of the steeper areas of this unit for building site development. Cuts needed to provide essentially level building sites can expose bedrock. Properly designing foundations and footings, diverting runoff away from the buildings, and backfilling with material that has a low shrink-swell potential help to prevent the structural damage caused by shrinking and swelling. Properly designing buildings and roads helps to offset the limited ability of the soil to support a load.

Erosion is a hazard on the steeper slopes. Only the part of the site that is used for construction should be disturbed. Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. Removal of cobbles in disturbed areas is needed for the best results in landscaping, particularly in areas used for lawns. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. In many areas it may be necessary to haul in topsoil for lawns and gardens. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

The vegetative site is Droughty Foothill Slopes, 18- to 22-inch precipitation zone.

29D—Carney cobbly clay, high precipitation, 5 to 20 percent slopes. This moderately deep, moderately well drained soil is on hillslopes. It formed in alluvium and colluvium derived dominantly from tuff and breccia. Elevation is 2,400 to 4,000 feet. The mean annual precipitation is 30 to 35 inches, the mean annual temperature is 45 to 54 degrees F, and the average frost-free period is 120 to 150 days. The native vegetation is mainly hardwoods and conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is dark brown cobbly clay about 6 inches thick. The next layer is dark brown clay about 6 inches thick. The subsoil also is dark brown clay. It is about 23 inches thick. Weathered bedrock is at a depth of about 35 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Included in this unit are small areas of Rock outcrop and McMullin soils on ridges and convex slopes, Coker soils on concave slopes, Medco soils, and soils that are similar to the Carney soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Carney soils that have slopes of less than 5 or more than 20 percent. Included areas make up about 20 percent of the total acreage.

Permeability is very slow in the Carney soil. Available water capacity is about 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is slow or medium, and the hazard of water erosion is slight or moderate. The water table fluctuates between depths of 3.0 and 3.5 feet from December through April.

This unit is used mainly for livestock grazing or wildlife habitat. It also is used for limited timber production.

This unit is poorly suited to the production of ponderosa pine. Other species that grow on this unit include Oregon white oak and California black oak. The understory vegetation includes poison-oak, California oatgrass, and Idaho fescue.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 70. The yield at culmination of the mean annual increment is 2,750 cubic feet per acre in a fully stocked, even-aged stand of trees at 50 years and 27,520 board feet per acre (Scribner rule) at 160 years.

The main limitations affecting timber production are compaction, erosion, slumping, the clayey surface layer, the seasonal wetness, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Conventional methods of harvesting timber generally are suitable, but the seasonal high water table and the clayey surface layer limit the use of equipment to dry periods. The soil may be compacted if it is moist when heavy equipment is used. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both.

This unit is subject to severe slumping. Road failure and landslides are likely to occur after road construction. Slumping can be minimized by constructing logging roads in the less sloping areas, on better suited soils if practical, and by installing properly designed road drainage systems. When wet or moist, unsurfaced roads and skid trails are sticky. They may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. Shrinking and swelling can damage roots or push seedlings out of the ground. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. The seedling mortality rate can be reduced by providing artificial shade for seedlings. Reforestation can be accomplished by planting ponderosa pine seedlings.

Undesirable plants, especially grasses, limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The main limitations affecting livestock grazing are compaction and erosion. The native vegetation suitable for grazing includes California oatgrass, Idaho fescue, and bluegrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Clayey Hills, 20- to 35-inch precipitation zone.

29E—Carney cobbly clay, high precipitation, 20 to 35 percent slopes. This moderately deep, moderately well drained soil is on hillslopes. It formed in alluvium and colluvium derived dominantly from tuff and breccia. Elevation is 2,400 to 4,000 feet. The mean annual precipitation is 30 to 35 inches, the mean annual temperature is 45 to 54 degrees F, and the average frost-free period is 120 to 150 days. The native vegetation is mainly hardwoods and conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is dark brown cobbly clay about 6 inches thick. The next layer is dark brown clay about 6 inches thick. The subsoil also is dark brown clay. It is about 23 inches thick. Weathered bedrock is at a depth of about 35 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Included in this unit are small areas of Rock outcrop and McMullin soils on ridges and convex slopes, Coker soils on concave slopes, and Medco soils. Also included are small areas of Heppsie soils on the steeper parts of the landscape, soils that are similar to the Carney soil but have bedrock at a depth of more than 40 inches, and Carney soils that have slopes of less than 20 or more than 35 percent. Included areas make up about 20 percent of the total acreage.

Permeability is very slow in the Carney soil. Available water capacity is about 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate. The water table fluctuates between depths of 3.0 and 3.5 feet from December through April.

This unit is used mainly for livestock grazing or wildlife habitat. It also is used for limited timber production.

This unit is poorly suited to the production of ponderosa pine. Other species that grow on this unit include Oregon white oak and California black oak. The understory vegetation includes poison-oak, California oatgrass, and Idaho fescue.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 70. The yield at culmination of the mean annual increment is 2,750 cubic feet per acre in a fully stocked, even-aged stand of trees at 50 years and 27,520 board feet per acre (Scribner rule) at 160 years.

The main limitations affecting timber production are erosion, compaction, slumping, the clayey surface layer, seasonal wetness, the slope, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

The seasonal high water table and the clayey surface layer limit the use of equipment to dry periods. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both.

This unit is subject to severe slumping. Road failure and landslides are likely to occur after road construction. Slumping can be minimized by constructing logging roads in the less sloping areas, on better suited soils if practical, and by installing properly designed road drainage systems. When wet or moist, unsurfaced roads and skid trails are sticky. They may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. Shrinking and swelling can damage roots or push seedlings out of the ground. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. The seedling mortality rate can be reduced by providing artificial shade for seedlings.

Reforestation can be accomplished by planting ponderosa pine seedlings.

Undesirable plants, especially grasses, limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The main limitations affecting livestock grazing are compaction and erosion. The native vegetation suitable for grazing includes California oatgrass, Idaho fescue, and bluegrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Clayey Hills, 20- to 35-inch precipitation zone.

30E—Carney-Tablerock complex, 20 to 35 percent slopes. This map unit is on alluvial fans and hillslopes. Elevation is 1,250 to 3,600 feet. The mean annual precipitation is 18 to 30 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 120 to 180 days. The native vegetation is mainly grasses, shrubs, and forbs.

This unit is about 45 percent Carney soil and 35 percent Tablerock soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Coker and Phoenix soils on concave slopes; Cove and Padigan soils on concave slopes near drainageways; Rock outcrop; and Brader, Debenger, and Darow soils. Also included are small areas of soils that are similar to the Carney soil but have bedrock at a depth of less than 20 or more than 40 inches, soils that are similar to the Tablerock soil but have bedrock within a depth of 60 inches, and Carney and Tablerock soils that have slopes of less than 20 or more than 35 percent. Included areas make up about 20 percent of the total acreage.

The Carney soil is moderately deep and moderately well drained. It formed in alluvium and colluvium derived dominantly from tuff and breccia. Typically, the surface layer is dark brown cobbly clay about 6 inches thick. The next layer is dark brown clay about 6 inches thick. The subsoil also is dark brown clay. It is about 23 inches thick. Weathered bedrock is at a depth of about 35 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Permeability is very slow in the Carney soil. Available water capacity is about 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate. The water table fluctuates between depths of 3.0 and 3.5 feet from December through April.

The Tablerock soil is very deep and moderately well drained. It formed in colluvium derived dominantly from tuff, breccia, andesite, and sandstone. Typically, the surface is covered with a layer of leaves and twigs about 1½ inches thick. The surface layer is very dark brown gravelly loam about 3 inches thick. The next layer is very dark grayish brown very cobbly clay loam about 7 inches thick. The upper 10 inches of the subsoil is dark brown very cobbly clay loam. The next 18 inches is brown very cobbly clay. The lower 27 inches is dark yellowish brown gravelly clay loam and gravelly loam. Weathered bedrock is at a depth of about 65 inches. The depth to bedrock is 60 inches or more. In some areas the surface layer is cobbly or stony.

Permeability is very slow in the Tablerock soil. Available water capacity is about 7 inches. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The water table fluctuates between depths of 4 and 6 feet from December through April.

This unit is used for livestock grazing and recreational development.

The main limitations affecting livestock grazing are the cobbly surface layer of the Carney soil, compaction, erosion, the slope, droughtiness, and the included areas of Rock outcrop. The vegetation suitable for grazing includes Idaho fescue, bluebunch wheatgrass, and Lemmon needlegrass. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock.

Range seeding is suitable if the site is in poor condition. The main limitations are the surface layer of cobbly clay in the Carney soil, the slope, droughtiness, and the included areas of Rock outcrop. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment. In places the use of ground equipment and access by livestock are limited by the slope, the cobbles on the surface, and the included areas of Rock outcrop.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the slope of both soils and the depth to bedrock in the Carney soil.

If this unit is used for recreational development, the main limitations are the high content of clay, the surface layer of cobbly clay in the Carney soil, the slope, and the included areas of Rock outcrop. The Rock outcrop should be avoided unless it is to be highlighted in the development. Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. A plant cover can be established and maintained through applications of fertilizer and through seeding, mulching, and shaping of the slopes. Gravel and cobbles should be removed, particularly in picnic areas and on playgrounds. The soils are sticky and plastic when wet. As a result, trafficability is restricted.

The vegetative site in areas of the Carney soil is Droughty Foothill Slopes, 18- to 22-inch precipitation zone, and the one in areas of the Tablerock soil is Droughty Fan, 18- to 26-inch precipitation zone.

31A—Central Point sandy loam, 0 to 3 percent slopes. This very deep, well drained soil is on stream terraces. It formed in alluvium derived dominantly from granitic and metamorphic rock. Elevation is 1,000 to 2,000 feet. The mean annual precipitation is 18 to 40 inches, the mean annual temperature is 50 to 54 degrees F, and the average frost-free period is 140 to 180 days. The vegetation in areas that have not been cultivated is mainly grasses and forbs.

Typically, the surface layer is black and very dark brown sandy loam about 30 inches thick. The upper 12 inches of the subsoil is very dark grayish brown sandy loam. The lower 7 inches is dark brown sandy loam. The upper 10 inches of the substratum is dark brown gravelly sandy loam. The lower part to a depth of 67 inches is dark brown gravelly loamy sand.

Included in this unit are small areas of Evans, Newberg, and Camas soils on flood plains; Barron soils on the higher parts of the landscape; Gregory and Clawson soils on concave slopes; Kubli and Medford soils; and soils that are similar to the Central Point soil but have very gravelly layers below a depth of 30 inches. Also included are small areas of Central Point soils that have slopes of more than 3 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately rapid in the Central Point soil. Available water capacity is about 6 inches. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The water table fluctuates between depths of 4 and 6 feet from December through March.

This unit is used mainly for irrigated crops, such as grass seed, onions, alfalfa, and tree fruit. Other crops include strawberries, small grain, and sugar beet seed. Some areas are used for homesite development or pasture.

This unit is well suited to irrigated crops. It has few limitations. In summer, irrigation is needed for the maximum production of most crops. Furrow, border, corrugation, trickle, and sprinkler irrigation systems are suitable. The system used generally is governed by the crop that is grown. For the efficient application and removal of surface irrigation water, land leveling is needed. To prevent overirrigation and the leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. Because the soil is droughty, the applications should be light and frequent. The use of pipe, ditch lining, or drop structures in irrigation ditches reduces water loss and the hazard of erosion.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Leaving crop residue on or near the surface helps to conserve moisture and control erosion.

A tillage pan forms easily if this unit is tilled when wet. Chiseling or subsoiling breaks up the pan. Surface crusting and compaction can be minimized by returning crop residue to the soil.

Solid-set sprinkler irrigation is the best method of controlling frost and providing adequate moisture for tree fruit. Compaction can be minimized by limiting the use of equipment when the soil is wet. A permanent cover crop helps to control runoff and erosion.

Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes.

Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

This unit is well suited to homesite development. It has few limitations. Cutbanks are not stable and are subject to slumping. To keep cutbanks from caving in, excavations may require special retainer walls. Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. Because of a low amount of rainfall and droughtiness in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

The vegetative site is Deep Loamy Terrace, 18- to 28-inch precipitation zone.

32B—Clawson sandy loam, 2 to 5 percent slopes. This very deep, poorly drained soil is on alluvial fans. It formed in alluvium derived dominantly from granitic rock. Elevation is 1,000 to 1,300 feet. The mean annual precipitation is 30 to 35 inches, the mean annual temperature is 52 to 54 degrees F, and the average frost-free period is 140 to 170 days. The vegetation in areas that have not been cultivated is mainly grasses, sedges, and forbs.

Typically, the surface layer is very dark grayish brown sandy loam about 10 inches thick. The subsoil is dark grayish brown sandy loam about 35 inches thick. The substratum to a depth of 60 inches is dark grayish brown and grayish brown sandy loam. In some areas the surface layer is gravelly.

Included in this unit are small areas of Barron and Shefflein soils on convex slopes and on the higher parts of the landscape; Central Point, Kubli, and Medford soils; and soils that are similar to the Clawson soil but have gravelly layers within a depth of 40 inches. Also included are small areas of Clawson soils that have slopes of more than 5 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately rapid in the Clawson soil. Available water capacity is about 7 inches. The effective rooting depth is limited by the water table, which is at a depth of 1 to 3 feet from November through June. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for hay and pasture or for homesite development.

This unit is suited to hay and pasture. The main limitations are wetness in winter and spring and droughtiness in summer and fall. Tile drainage can lower the water table if a suitable outlet is available. Land smoothing and open ditches can reduce surface wetness.

In summer, irrigation is needed for the maximum production of most forage crops. Sprinkler irrigation is the best method of applying water. This method permits an even, controlled application of water, helps to prevent excessive runoff, and minimizes the risk of erosion. Border and contour flood irrigation systems also are suitable. For the efficient application and removal of surface irrigation water, land leveling is needed. To prevent overirrigation and the leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. The use of pipe, ditch lining, or drop structures in irrigation ditches reduces water loss and the hazard of erosion.

Wetness limits the choice of suitable forage plants and the period of cutting or grazing and increases the risk of winterkill. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

This unit is limited as a site for livestock watering ponds and other water impoundments because of seepage.

The main limitations affecting homesite development are wetness in winter and spring and the moderately rapid permeability.

This unit is poorly suited to standard systems of waste disposal because of the wetness. Interceptor ditches can divert subsurface water and thus improve the efficiency of the absorption fields. Alternative waste disposal systems may function properly on this unit. Suitable included soils are throughout the unit. Onsite investigation is needed to locate such soils.

Because of the seasonal high water table, a drainage system is needed on sites for buildings with basements and crawl spaces. The wetness can be reduced by installing drainage tile around footings. Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. Because of droughtiness and a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

Cutbanks are not stable and are subject to slumping. To keep cutbanks from caving in, excavations may require special retainer walls.

The vegetative site is Semi-Wet Meadow.

33A—Coker clay, 0 to 3 percent slopes. This very deep, somewhat poorly drained soil is on alluvial fans. It formed in alluvium derived dominantly from tuff and breccia. Elevation is 1,200 to 4,000 feet. The mean annual precipitation is 18 to 30 inches, the mean annual temperature is 46 to 54 degrees F, and the average frost-free period is 120 to 180 days. The native vegetation is mainly grasses, sedges, and forbs.

Typically, the surface layer is very dark gray clay about 20 inches thick. The next layer is very dark gray and dark grayish brown, calcareous clay about 26 inches thick. The subsoil to a depth of 70 inches is dark grayish brown, calcareous clay. The depth to bedrock is 60 inches or more.

Included in this unit are small areas of Brader, Carney, Darow, and Debenger soils on convex slopes; Cove, Gregory, and Padigan soils on concave slopes near drainageways; Medford and Phoenix soils; and soils that are similar to the Coker soil but have bedrock at a depth of 40 to 60 inches. Also included are small areas of Coker soils that have slopes of more than 3 percent. Included areas make up about 20 percent of the total acreage.

Permeability is very slow in the Coker soil. Available water capacity is about 9 inches. The effective rooting depth is limited by the water table, which is at a depth of 0.5 foot to 1.5 feet from December through April. Runoff is slow, and the hazard of water erosion is slight.

This unit is used mainly for hay and pasture or for tree fruit. It also is used for livestock grazing, small grain, and homesite development.

This unit is suited to irrigated crops. It is limited mainly by the high content of clay, a slow rate of water intake, wetness in winter and spring, and droughtiness in summer and fall. Crops that require good drainage can be grown if a properly designed drainage system is installed. The ability of tile drains to remove subsurface water from the soil is limited because of the very slow permeability.

In summer, irrigation is needed for the maximum production of most crops. Sprinkler and trickle irrigation systems are suitable. Border and contour flood systems also are suitable. For the efficient application and removal of surface irrigation water, land leveling is needed. Because of the very slow permeability and the water table, water applications should be regulated so that the water does not stand on the surface and damage the crop. Land smoothing and open ditches can reduce surface wetness. The use of pipe, ditch lining, or drop structures in irrigation ditches reduces water loss and the hazard of erosion.

Solid-set sprinkler irrigation is the best method of controlling frost and providing adequate moisture for tree fruit. Compaction can be minimized by limiting the use of equipment when the soil is wet. A permanent cover crop helps to control runoff and erosion.

This unit is well suited to permanent pasture. Wetness limits the choice of suitable forage plants and the period of cutting or grazing and increases the risk of winterkill. The high content of clay severely limits tillage and root growth. Deep cracks form as the soil dries in summer. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

The main limitations affecting livestock grazing are compaction, the clayey surface layer, wetness in winter and spring, and droughtiness in summer and fall. The vegetation suitable for grazing includes California oatgrass, bluegrass, and sedge. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

Because this soil remains wet for long periods in spring, grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock. Compaction can be minimized by grazing first in the areas that dry out earliest.

Range seeding is suitable if the site is in poor condition. The main limitations are the clayey surface layer, wetness in winter and spring, and droughtiness in summer and fall. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment.

This unit is suited to livestock watering ponds and other water impoundments.

The main limitations affecting homesite development are the wetness, a high shrink-swell potential, the very slow permeability, and low strength.

This unit is poorly suited to standard systems of waste disposal because of the wetness and the very slow permeability. Alternative waste disposal systems may function properly on this unit. Suitable included soils are in some areas of the unit. Onsite investigation is needed to locate such soils.

A drainage system is needed if roads or building foundations are constructed on this unit. The wetness can be reduced by installing drainage tile around footings. Properly designing foundations and footings, diverting runoff away from the buildings, and backfilling with material that has a low shrink-swell potential help to prevent the structural damage caused by shrinking and swelling. Properly designing buildings and roads helps to offset the limited ability of the soil to support a load.

Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. In many areas it may be necessary to haul in topsoil for lawns and gardens. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

The vegetative site is Semi-Wet Meadow.

33C—Coker clay, 3 to 12 percent slopes. This very deep, somewhat poorly drained soil is on alluvial fans. It formed in alluvium derived dominantly from tuff and breccia. Elevation is 1,200 to 4,000 feet. The mean annual precipitation is 18 to 30 inches, the mean annual temperature is 46 to 54 degrees F, and the average frost-free period is 120 to 180 days. The native vegetation is mainly grasses, sedges, and forbs.

Typically, the surface layer is very dark gray clay about 20 inches thick. The next layer is very dark gray and dark grayish brown, calcareous clay about 26 inches thick. The subsoil to a depth of 70 inches is dark grayish brown, calcareous clay. The depth to bedrock is 60 inches or more.

Included in this unit are small areas of Brader, Carney, Darow, and Debenger soils on convex slopes; Cove, Gregory, and Padigan soils on concave slopes near drainageways; Medford and Phoenix soils; and soils that are similar to the Coker soil but have bedrock at a depth of 40 to 60 inches. Also included are small areas of Coker soils that have slopes of less than 3 or more than 12 percent. Included areas make up about 20 percent of the total acreage.

Permeability is very slow in the Coker soil. Available water capacity is about 9 inches. The effective rooting depth is limited by the water table, which is at a depth of 0.5 foot to 1.5 feet from December through April. Runoff is slow, and the hazard of water erosion is slight.

This unit is used mainly for hay and pasture or for tree fruit. It also is used for livestock grazing, small grain, and homesite development.

This unit is suited to irrigated crops. It is limited mainly by the high content of clay, a slow rate of water intake, wetness in winter and spring, droughtiness in summer and fall, and the slope. Crops that require good drainage can be grown if a properly designed tile drainage system is installed. The ability of tile drains to remove subsurface water from the soil is limited because of the very slow permeability.

In summer, irrigation is needed for the maximum production of most crops. Because of the slope, sprinkler and trickle irrigation systems are the best methods of applying water. These systems permit an even, controlled application of water, help to prevent excessive runoff, and minimize the risk of erosion. Border and contour flood irrigation systems also are suitable in the less sloping areas. For the efficient application and removal of surface irrigation water, land leveling is needed. To prevent overirrigation and excessive erosion, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. The use of pipe, ditch lining, or drop structures in irrigation ditches reduces water loss and the hazard of erosion.

Solid-set sprinkler irrigation is the best method of controlling frost and providing adequate moisture for tree fruit. Compaction can be minimized by limiting the use of equipment when the soil is wet. Growing a permanent cover crop helps to control runoff and reduces the hazard of erosion.

This unit is well suited to permanent pasture. Wetness limits the choice of suitable forage plants and the period of cutting or grazing and increases the risk of winterkill. The high content of clay severely limits tillage and root growth. Deep cracks form as the soil dries in summer. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

The main limitations affecting livestock grazing are compaction, erosion, the clayey surface layer, wetness in winter and spring, and droughtiness in summer and fall. The vegetation suitable for grazing includes California oatgrass, bluegrass, and sedge. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

Because this soil remains wet for long periods in spring, grazing should be delayed until the soil is firm and the more desirable forage plants have achieved enough growth to withstand grazing pressure. Compaction can be minimized by grazing first in the areas that dry out earliest.

Range seeding is suitable if the site is in poor condition. The main limitations are the clayey surface layer, wetness in winter and spring, and droughtiness in summer and fall. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the slope.

The main limitations affecting homesite development are the wetness, a high shrink-swell potential, the very slow permeability, and low strength.

This unit is poorly suited to standard systems of waste disposal because of the wetness and the very slow permeability. Alternative waste disposal systems may function properly on this unit. Suitable included soils are in some areas of the unit. Onsite investigation is needed to locate such soils.

A drainage system is needed if roads or building foundations are constructed on this unit. The wetness can be reduced by installing drainage tile around footings. Properly designing foundations and footings, diverting runoff away from the buildings, and backfilling with material that has a low shrink-swell potential help to prevent the structural damage caused by shrinking and swelling. Properly designing buildings and roads helps to offset the limited ability of the soil to support a load.

Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. In many areas it may be necessary to haul in topsoil for lawns and gardens. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

The vegetative site is Semi-Wet Meadow.

34B—Coleman loam, 0 to 7 percent slopes. This very deep, moderately well drained soil is on stream terraces. It formed in alluvium derived dominantly from sedimentary and volcanic rock. Elevation is 1,200 to 1,700 feet. The mean annual precipitation is 18 to 25 inches, the mean annual temperature is 50 to 54 degrees F, and the average frost-free period is 160 to 180 days. The vegetation in areas that have not been cultivated is mainly hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is dark brown loam about 8 inches thick. The next layer is dark brown clay loam about 12 inches thick. The subsoil is dark brown clay about 20 inches thick. The upper 18 inches of the substratum is dark brown clay loam. The lower part to a depth of 65 inches is yellowish red clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is gravelly.

Included in this unit are small areas of Gregory and Medford soils on the lower terraces and Ruch soils on alluvial fans. Also included are small areas of Coleman soils that have slopes of more than 7 percent. Included areas make up about 15 percent of the total acreage.

Permeability is slow in the Coleman soil. Available water capacity is about 10 inches. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The water table fluctuates between depths of 1.5 and 2.0 feet from December through April.

This unit is used mainly for irrigated crops, such as alfalfa hay, tree fruit, and small grain. Other crops include corn for silage and sugar beet seed. Some areas are used for homesite development, grass hay, or pasture.

This unit is suited to irrigated crops. It is limited mainly by wetness in winter and spring and by the slow permeability. Crops that require good drainage can be grown if a properly designed tile drainage system is installed. Tile drainage can lower the water table if collection laterals are closely spaced and a suitable outlet is available. In the less sloping areas, land smoothing and open ditches can reduce surface wetness.

In summer, irrigation is needed for the maximum production of most crops. Furrow, border, corrugation, trickle, and sprinkler irrigation systems are suitable. The system used generally is governed by the crop that is grown. For the efficient application and removal of surface irrigation water, land leveling is needed. To prevent overirrigation, development of a perched water table, and an increase in the risk of erosion, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. The use of pipe, ditch lining, or drop structures in irrigation ditches reduces water loss and the hazard of erosion.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Leaving crop residue on or near the surface helps to conserve moisture and control erosion.

A tillage pan forms easily if the soil is tilled when wet.

Chiseling or subsoiling breaks up the pan. Surface crusting and compaction can be minimized by returning crop residue to the soil.

Solid-set sprinkler irrigation is the best method of controlling frost and providing adequate moisture for tree fruit. Compaction can be minimized by limiting the use of equipment when the soil is wet and by planting a cover crop. Growing a permanent cover crop helps to control runoff and reduces the hazard of erosion.

Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

The main limitations affecting homesite development are the wetness, the slow permeability, a high shrink-swell potential, and low strength.

The slow permeability and the water table increase the possibility that septic tank absorption fields will fail. Interceptor ditches can divert subsurface water and thus improve the efficiency of the absorption fields. Alternative waste disposal systems may function properly on this unit. Suitable included soils are throughout the unit. Onsite investigation is needed to locate such soils.

A seasonal high water table is perched above the layer of clay; therefore, a drainage system is needed on sites for buildings with basements and crawl spaces. The wetness can be reduced by installing drainage tile around footings. Properly designing foundations and footings, diverting runoff away from the buildings, and backfilling with material that has a low shrink-swell potential help to prevent the structural damage caused by shrinking and swelling. Properly designing buildings and roads helps to offset the limited ability of the subsoil to support a load.

Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. In many areas it may be necessary to haul in topsoil for lawns and gardens. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

The vegetative site is Loamy Hills, 20- to 35-inch precipitation zone.

35A—Cove clay, 0 to 3 percent slopes. This very deep, poorly drained soil is on flood plains. It formed in alluvium derived dominantly from tuff and breccia. Elevation is 1,200 to 2,500 feet. The mean annual precipitation is 18 to 30 inches, the mean annual temperature is 50 to 54 degrees F, and the average frost-free period is 140 to 180 days. The native vegetation is mainly grasses, sedges, and forbs.

Typically, the surface layer is black clay about 16 inches thick. The subsoil is very dark grayish brown silty clay about 34 inches thick. The substratum to a depth of 60 inches is dark grayish brown silty clay. The depth to bedrock is 60 inches or more. In some areas the surface layer is silty clay loam.

Included in this unit are small areas of Carney soils on convex slopes; Coker, Gregory, and Padigan soils; and soils that are similar to the Cove soil but are very gravelly within a depth of 30 inches. Also included are small areas of Cove soils that have slopes of more than 3 percent. Included areas make up about 10 percent of the total acreage.

Permeability is very slow in the Cove soil. Available water capacity is about 9 inches. The effective rooting depth is limited by the water table, which is within a depth of 1 foot from December through June. Runoff is slow, and the hazard of water erosion is slight. This soil is frequently flooded for brief periods from December through April.

This unit is used mainly for pasture. It also is used for tree fruit, grass-legume hay, and homesite development.

This unit is suited to permanent pasture. It is limited mainly by the hazard of flooding, the wetness, the high content of clay, and a slow rate of water intake. The risk of flooding can be reduced by levees, dikes, and diversions. The ability of tile drains to remove subsurface water from the soil is limited because of the very slow permeability.

In summer, irrigation is needed for the maximum production of most forage crops. Sprinkler irrigation is the best method of applying water. Border and contour flood irrigation systems also are suitable. For the efficient application and removal of surface irrigation water, land leveling is needed. Because of the very slow permeability and the seasonal high water table, water applications should be regulated so that the water does not stand on the surface and damage the crop. Land smoothing and open ditches can reduce surface wetness. The use of pipe, ditch lining, or drop structures in irrigation ditches reduces water loss and the hazard of erosion.

Wetness limits the choice of suitable forage plants and the period of cutting or grazing and increases the risk of winterkill. Maintaining a protective plant cover in winter reduces the soil loss resulting from flooding. The high content of clay severely limits tillage and root growth. Deep cracks form as the soil dries in summer. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

Solid-set sprinkler irrigation is the best method of controlling frost and providing adequate moisture for tree fruit. Compaction can be minimized by limiting the use of equipment when the soil is wet and by planting a cover crop. A permanent sod crop helps to control runoff.

This unit is poorly suited to homesite development. The main limitations are the flooding, the wetness, a high shrink-swell potential, and the very slow permeability.

This unit is poorly suited to standard systems of waste disposal because of the hazard of flooding, the wetness, and the very slow permeability. Alternative waste disposal systems may function properly on this unit. Suitable included soils are throughout the unit. Onsite investigation is needed to locate such soils.

A drainage system is needed if roads or building foundations are constructed on this unit. The wetness can be reduced by installing drainage tile around footings. Properly designing foundations and footings, diverting runoff away from the buildings, and backfilling with material that has a low shrink-swell potential help to prevent the structural damage caused by shrinking and swelling. Properly designing buildings and roads helps to offset the limited ability of the soil to support a load. Roads and streets should be constructed above the expected level of flooding.

Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. In many areas it may be necessary to haul in topsoil for lawns and gardens. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

The vegetative site is Poorly Drained Bottom.

36G—Coyata-Rock outcrop complex, 35 to 80 percent north slopes. This map unit is on hillslopes. Elevation is 2,000 to 4,000 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 50 percent Coyata soil and 30 percent Rock outcrop. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Crater Lake, Dumont, and Reinecke soils on the less sloping parts of the landscape; soils that are similar to the Coyata soil but have bedrock at a depth of more than 40 inches; and Coyata soils that have slopes of less than 35 or more than 80 percent. Included areas make up about 20 percent of the total acreage.

The Coyata soil is moderately deep and well drained. It formed in colluvium derived dominantly from andesite. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1½ inches thick. The surface layer is dark reddish brown very stony loam about 11 inches thick. The next layer is dark brown very cobbly clay loam about 10 inches thick. The subsoil is dark brown extremely cobbly clay loam about 10 inches thick. Bedrock is at a depth of about 31 inches. The depth to bedrock ranges from 20 to 40 inches.

Permeability is moderate in the Coyata soil. Available water capacity is about 2 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

Rock outcrop consists of areas of exposed bedrock. Runoff is very rapid in these areas.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir. Other species that grow on this unit include white fir, western hemlock, and golden chinkapin. The understory vegetation includes vine maple, California hazel, and cascade Oregongrape.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 130 on the Coyata soil. The yield at culmination of the mean annual increment is 7,740 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 58,520 board feet per acre (Scribner rule) at 110 years. On the basis of a 50-year curve, the mean site index is 100.

The main limitations affecting timber production are the slope, the Rock outcrop, erosion, plant competition, and seedling mortality. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

The slope restricts the use of wheeled and tracked logging equipment. High-lead or other cable systems are the best methods of logging. The Rock outcrop can cause breakage of falling timber and can hinder yarding. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Ripping landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Road cuts can expose a large amount of fractured bedrock, which limits the response to seeding and mulching. Steep yarding paths and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both.

Building logging roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. The large number of rock fragments in the soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings.

Because of the slope and the Rock outcrop, areas of this unit can hinder livestock movement.

The vegetative site is Mixed Fir-Western Hemlock Forest.

37G—Coyata-Rock outcrop complex, 35 to 80 percent south slopes. This map unit is on hillslopes. Elevation is 2,000 to 4,000 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 50 percent Coyata soil and 30 percent Rock outcrop. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Crater Lake, Dumont, and Reinecke soils on the less sloping parts of the landscape; soils that are similar to the Coyata soil but have bedrock at a depth of more than 40 inches; and Coyata soils that have slopes of less than 35 or more than 80 percent. Included areas make up about 20 percent of the total acreage.

The Coyata soil is moderately deep and well drained. It formed in colluvium derived dominantly from andesite. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1½ inches thick. The surface layer is dark reddish brown very stony loam about 11 inches thick. The next layer is dark brown very cobbly clay loam about 10 inches thick. The subsoil is dark brown extremely cobbly clay loam about 10 inches thick. Bedrock is at a depth of about 31 inches. The depth to bedrock ranges from 20 to 40 inches.

Permeability is moderate in the Coyata soil. Available water capacity is about 2 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

Rock outcrop consists of areas of exposed bedrock. Runoff is very rapid in these areas.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir. Other species that grow on this unit include white fir, incense cedar, and Pacific madrone. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 120 on the Coyata soil. The yield at culmination of the mean annual increment is 6,900 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 52,440 board feet per acre (Scribner rule) at 120 years. On the basis of a 50-year curve, the mean site index is 90.

The main limitations affecting timber production are the slope, the Rock outcrop, erosion, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

The slope restricts the use of wheeled and tracked logging equipment. High-lead or other cable systems are the best methods of logging. The Rock outcrop can cause breakage of falling timber and can hinder yarding. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Ripping landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Road cuts can expose a large amount of fractured bedrock, which limits the response to seeding and mulching. Steep yarding paths and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both.

Building logging roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. The large number of rock fragments in the soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced by providing artificial shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

Because of the slope and the Rock outcrop, areas of this unit can hinder livestock movement.

The vegetative site is Mixed Fir-Mixed Pine Forest.

38C—Crater Lake-Alcot complex, 1 to 12 percent slopes. This map unit is on plateaus. Elevation is 2,000 to 3,200 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 150 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

This unit is about 55 percent Crater Lake soil and 35 percent Alcot soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Barhiskey, Coyata, Dumont, and Reinecke soils; soils that are similar to the Crater Lake and Alcot soils but have bedrock at a depth of 40 to 60 inches; and poorly drained soils near drainageways and on concave slopes. Also included are small areas of Crater Lake and Alcot soils that have slopes of more than 12 percent. Included areas make up about 10 percent of the total acreage.

The Crater Lake soil is very deep and well drained. It formed in volcanic ash and pumice. Typically, the surface is covered with a layer of needles and twigs about 3 inches thick. The surface layer is dark yellowish brown sandy loam about 5 inches thick. The subsoil also is dark yellowish brown sandy loam. It is about 17 inches thick. The substratum to a depth of 60 inches is strong brown and brown sandy loam. The depth to bedrock is 60 inches or more.

Permeability is moderately rapid in the Crater Lake soil. Available water capacity is about 12 inches. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

The Alcot soil is very deep and somewhat excessively drained. It formed in volcanic ash and pumice. Typically, the surface is covered with a layer of needles and twigs about 2 inches thick. The surface layer is brown gravelly sandy loam about 4 inches thick. The subsoil also is brown gravelly sandy loam. It is about 7 inches thick. The substratum to a depth of 60 inches is dark yellowish brown and dark grayish brown very cobbly sandy loam. The depth to bedrock is 60 inches or more.

Permeability is rapid in the Alcot soil. Available water capacity is about 9 inches. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used mainly for timber production, livestock grazing, or wildlife habitat. It also is used for homesite development.

This unit is suited to the production of Douglas fir. Other species that grow on this unit include white fir, western hemlock, and golden chinkapin. The understory vegetation includes vine maple, California hazel, and cascade Oregongrape.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 145 on both the Crater Lake and Alcot soils. The yield at culmination of the mean annual increment is 9,120 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 74,360 board feet per acre (Scribner rule) at 110 years. On the basis of a 50-year curve, the mean site index is 110.

The main limitations affecting timber production are compaction, erosion, plant competition, and seedling mortality. Conventional methods of harvesting timber generally are suitable, but the soils may be compacted if they are moist when heavy equipment is used. Because of the high content of volcanic ash, displacement of the surface layer occurs most readily when the soils are dry. Puddling can occur when the soils are wet. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Logging roads require suitable surfacing for year-round use. Construction and maintenance of roads may be difficult because of the volcanic ash, which is poor subgrade material because it is not easily compacted when dry, has a moderate potential for frost action, and has a high water-holding capacity. When wet or moist, unsurfaced roads and skid trails are soft. They may be impassable during rainy periods. When dry, they are very dusty.

Erosion can be controlled by carefully planning the construction and maintenance of logging roads, skid trails, and landings. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

Severe frost can damage or kill seedlings. Air drainage may be restricted on this unit. Proper timber harvesting methods can reduce the effect of frost on regeneration.

The main limitations affecting livestock grazing are compaction and soil displacement. The native vegetation suitable for grazing includes western fescue, mountain brome, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soils. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock. Displacement of the surface layer occurs most readily when the soils are dry.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion. The seedling survival rate may be reduced if this unit is grazed when the soils are susceptible to displacement.

This unit is suited to homesite development. The main limitations are the rapid permeability in the Alcot soil and the high content of volcanic ash and pumice in both soils. This material has a moderate potential for frost action.

In some areas excavation for houses and access roads exposes material that is highly susceptible to soil blowing. Revegetating as soon as possible in disturbed areas around construction sites helps to control soil blowing.

Removal of large pieces of pumice in disturbed areas is needed for the best results in landscaping, particularly in areas used for lawns. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

The vegetative site is Mixed Fir-Western Hemlock Forest.

39E—Crater Lake-Alcot complex, 12 to 35 percent north slopes. This map unit is on hillslopes. Elevation is 2,000 to 3,200 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 150 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

This unit is about 50 percent Crater Lake soil and 30 percent Alcot soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Coyata, Dumont, and Reinecke soils; Rock outcrop on convex slopes; soils that are similar to the Crater Lake and Alcot soils but have bedrock at a depth of 40 to 60 inches; and poorly drained soils near drainageways and on concave slopes. Also included are small areas of Crater Lake and Alcot soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 20 percent of the total acreage.

The Crater Lake soil is very deep and well drained. It formed in volcanic ash and pumice. Typically, the surface is covered with a layer of needles and twigs about 3 inches thick. The surface layer is dark yellowish brown sandy loam about 5 inches thick. The subsoil also is dark yellowish brown sandy loam. It is about 17 inches thick. The substratum to a depth of 60 inches is strong brown and brown sandy loam. The depth to bedrock is 60 inches or more.

Permeability is moderately rapid in the Crater Lake soil. Available water capacity is about 12 inches. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate or high.

The Alcot soil is very deep and somewhat excessively drained. It formed in volcanic ash and pumice. Typically, the surface is covered with a layer of needles and twigs about 2 inches thick. The surface layer is brown gravelly sandy loam about 4 inches thick. The subsoil also is brown gravelly sandy loam. It is about 7 inches thick. The substratum to a depth of 60 inches is dark yellowish brown and dark grayish brown very cobbly sandy loam. The depth to bedrock is 60 inches or more.

Permeability is rapid in the Alcot soil. Available water capacity is about 9 inches. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate or high.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir. Other species that grow on this unit include white fir, western hemlock, and golden chinkapin. The understory vegetation includes vine maple, California hazel, and cascade Oregongrape.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 145 on both the Crater Lake and Alcot soils. The yield at culmination of the mean annual increment is 9,120 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 74,360 board feet per acre (Scribner rule) at 110 years. On the basis of a 50-year curve, the mean site index is 110.

The main limitations affecting timber production are erosion, compaction, and plant competition. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. Using standard wheeled and tracked equipment when the soils are moist causes rutting and compaction. Because of the high content of volcanic ash, displacement of the surface layer occurs most readily when the soils are dry. Puddling can occur when the soils are wet. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Logging roads require suitable surfacing for year-round use. Construction and maintenance of roads may be difficult because of the volcanic ash, which is poor subgrade material because it is not easily compacted when dry, has a moderate potential for frost action, and has a high water-holding capacity. When wet or moist, unsurfaced roads and skid trails are soft. They may be impassable during rainy periods. When dry, they are very dusty.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The main limitations affecting livestock grazing are compaction, erosion, and soil displacement. The native vegetation suitable for grazing includes western fescue, mountain brome, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soils. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock. Displacement of the surface layer occurs most readily when the soils are dry.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion. The seedling survival rate may be reduced if this unit is grazed when the soils are susceptible to displacement.

The vegetative site is Mixed Fir-Western Hemlock Forest.

40E—Crater Lake-Alcot complex, 12 to 35 percent south slopes. This map unit is on hillslopes. Elevation is 2,000 to 3,200 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 150 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

This unit is about 50 percent Crater Lake soil and 30 percent Alcot soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Coyata, Dumont, and Reinecke soils; Rock outcrop on convex slopes; soils that are similar to the Crater Lake and Alcot soils but have bedrock at a depth of 40 to 60 inches; and poorly drained soils near drainageways and on concave slopes. Also included are small areas of Crater Lake and Alcot soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 20 percent of the total acreage.

The Crater Lake soil is very deep and well drained. It formed in volcanic ash and pumice. Typically, the surface is covered with a layer of needles and twigs about 3 inches thick. The surface layer is dark yellowish brown sandy loam about 5 inches thick. The subsoil also is dark yellowish brown sandy loam. It is about 17 inches thick. The substratum to a depth of 60 inches is strong brown and brown sandy loam. The depth to bedrock is 60 inches or more.

Permeability is moderately rapid in the Crater Lake soil. Available water capacity is about 12 inches. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate or high.

The Alcot soil is very deep and somewhat excessively drained. It formed in volcanic ash and pumice. Typically, the surface is covered with a layer of needles and twigs about 2 inches thick. The surface layer is brown gravelly sandy loam about 4 inches thick. The subsoil also is brown gravelly sandy loam. It is about 7 inches thick. The substratum to a depth of 60 inches is dark yellowish brown and dark grayish brown very cobbly sandy loam. The depth to bedrock is 60 inches or more.

Permeability is rapid in the Alcot soil. Available water capacity is about 9 inches. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate or high.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir. Other species that grow on this unit include white fir, incense cedar, sugar pine, and Pacific madrone. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 135 on both the Crater Lake and Alcot soils. The yield at culmination of the mean annual increment is 8,280 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 63,910 board feet per acre (Scribner rule) at 110 years. On the basis of a 50-year curve, the mean site index is 100.

The main limitations affecting timber production are erosion, compaction, plant competition, and seedling mortality. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. Using standard wheeled and tracked equipment when the soils are moist causes rutting and compaction. Because of the high content of volcanic ash, displacement of the surface layer occurs most readily when the soils are dry. Puddling can occur when the soils are wet. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Logging roads require suitable surfacing for year-round use. Construction and maintenance of roads may be difficult because of the volcanic ash, which is poor subgrade material because it is not easily compacted when dry, has a moderate potential for frost action, and has a high water-holding capacity. When wet or moist, unsurfaced roads and skid trails are soft. They may be impassable during rainy periods. When dry, they are very dusty.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings.

The main limitations affecting livestock grazing are compaction, erosion, and soil displacement. The native vegetation suitable for grazing includes western fescue, tall trisetum, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soils. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock. Displacement of the surface layer occurs most readily when the soils are dry.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion. The seedling survival rate may be reduced if this unit is grazed when the soils are too dry.

The vegetative site is Mixed Fir-Mixed Pine Forest.

41G—Crater Lake-Rock outcrop complex, 35 to 70 percent north slopes. This map unit is on hillslopes. Elevation is 2,000 to 3,200 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 150 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

This unit is about 55 percent Crater Lake soil and 20 percent Rock outcrop. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Alcot, Coyata, Dumont, and Reinecke soils; soils that are similar to the Crater Lake soil but have bedrock within a depth of 60 inches; and Crater Lake soils that have slopes of less than 35 or more than 70 percent. Included areas make up about 25 percent of the total acreage.

The Crater Lake soil is very deep and well drained. It formed in volcanic ash and pumice. Typically, the surface is covered with a layer of needles and twigs about 3 inches thick. The surface layer is dark yellowish brown sandy loam about 5 inches thick. The subsoil also is dark yellowish brown sandy loam. It is about 17 inches thick. The substratum to a depth of 60 inches is strong brown and brown sandy loam. The depth to bedrock is 60 inches or more.

Permeability is moderately rapid in the Crater Lake soil. Available water capacity is about 12 inches. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

Rock outcrop consists of areas of exposed bedrock. Runoff is very rapid in these areas.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir. Other species that grow on this unit include white fir, western hemlock, and golden chinkapin. The understory vegetation includes vine maple, California hazel, and cascade Oregongrape.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 145 on the Crater Lake soil. The yield at culmination of the mean annual increment is 9,120 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 74,360 board feet per acre (Scribner rule) at 110 years. On the basis of a 50-year curve, the mean site index is 110.

The main limitations affecting timber production are the slope, the Rock outcrop, erosion, compaction, and plant competition. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Because of the high content of volcanic ash, displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Logging roads require suitable surfacing for year-round use. Construction and maintenance of roads may be difficult because of the volcanic ash, which is poor subgrade material because it is not easily compacted when dry, has a moderate potential for frost action, and has a high water-holding capacity. When wet or moist, unsurfaced roads and skid trails are soft. They may be impassable during rainy periods. When dry, they are very dusty.

Properly designed road drainage systems that include carefully located culverts help to control erosion.

Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Building the roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The main limitations affecting livestock grazing are erosion, compaction, soil displacement, the slope, and the Rock outcrop. The native vegetation suitable for grazing includes western fescue, mountain brome, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock. Displacement of the surface layer occurs most readily when the soil is dry.

Because of the slope and the Rock outcrop, areas of this unit can hinder livestock movement.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion. The seedling survival rate may be reduced if this unit is grazed when the soil is too dry.

The vegetative site is Mixed Fir-Western Hemlock Forest.

42G—Crater Lake-Rock outcrop complex, 35 to 70 percent south slopes. This map unit is on hillslopes. Elevation is 2,000 to 3,200 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 150 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

This unit is about 55 percent Crater Lake soil and 20 percent Rock outcrop. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Alcot, Coyata, Dumont, and Reinecke soils; soils that are similar to the Crater Lake soil but have bedrock within a depth of 60 inches; and Crater Lake soils that have slopes of less than 35 or more than 70 percent. Included areas make up about 25 percent of the total acreage.

The Crater Lake soil is very deep and well drained. It formed in volcanic ash and pumice. Typically, the surface is covered with a layer of needles and twigs about 3 inches thick. The surface layer is dark yellowish brown sandy loam about 5 inches thick. The subsoil also is dark yellowish brown sandy loam. It is about 17 inches thick. The substratum to a depth of 60 inches is strong brown and brown sandy loam. The depth to bedrock is 60 inches or more.

Permeability is moderately rapid in the Crater Lake soil. Available water capacity is about 12 inches. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

Rock outcrop consists of areas of exposed bedrock. Runoff is very rapid in these areas.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir. Other species that grow on this unit include white fir, incense cedar, sugar pine, and Pacific madrone. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 135 on the Crater Lake soil. The yield at culmination of the mean annual increment is 8,280 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 63,910 board feet per acre (Scribner rule) at 110 years. On the basis of a 50-year curve, the mean site index is 100.

The main limitations affecting timber production are the slope, the Rock outcrop, erosion, compaction, seedling mortality, and plant competition. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Because of the high content of volcanic ash, displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Logging roads require suitable surfacing for year-round use. Construction and maintenance of roads may be difficult because of the volcanic ash, which is poor subgrade material because it is not easily compacted when dry, has a moderate potential for frost action, and has a high water-holding capacity. When wet or moist, unsurfaced roads and skid trails are soft. They may be impassable during rainy periods. When dry, they are very dusty.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Building the roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced by providing artificial shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The main limitations affecting livestock grazing are erosion, compaction, soil displacement, the slope, and the Rock outcrop. The native vegetation suitable for grazing includes western fescue, tall trisetum, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock. Displacement of the surface layer occurs most readily when the soil is dry.

Because of the slope and the Rock outcrop, areas of this unit can hinder livestock movement.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion. The seedling survival rate may be reduced if this unit is grazed when the soil is too dry.

The vegetative site is Mixed Fir-Mixed Pine Forest.

43B—Darow silty clay loam, 1 to 5 percent slopes. This moderately deep, moderately well drained soil is on hillslopes. It formed in residuum derived dominantly from siltstone. Elevation is 1,200 to 3,000 feet. The mean annual precipitation is 18 to 30 inches, the mean annual temperature is 52 to 54 degrees F, and the average frost-free period is 120 to 180 days. The native vegetation is mainly hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is dark brown silty clay loam about 12 inches thick. The subsoil is dark brown and dark yellowish brown silty clay about 20 inches thick. Weathered bedrock is at a depth of about 32 inches. The depth to bedrock ranges from 20 to 40 inches.

Included in this unit are small areas of Brader and Debenger soils on ridges and convex slopes; Carney, Coker, and Selmac soils on concave slopes; Cove, Gregory, and Padigan soils near drainageways; Manita soils; and soils that are similar to the Darow soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Darow soils that have slopes of more than 5 percent. Included areas make up about 20 percent of the total acreage.

Permeability is slow in the Darow soil. Available water capacity is about 5 inches. The effective rooting depth is 20 to 40 inches. Runoff is slow, and the hazard of water erosion is slight. The water table fluctuates between depths of 3.0 and 3.5 feet from December through April.

This unit is used mainly for hay and pasture or for tree fruit. It also is used for homesite development and livestock grazing.

This unit is suited to irrigated crops. It is limited mainly by the high content of clay, a slow rate of water intake, and droughtiness. In summer, irrigation is needed for the maximum production of most crops. Sprinkler and trickle irrigation systems are suitable. These systems permit an even, controlled application of water, help to prevent excessive runoff, and minimize the risk of erosion. Border and contour flood irrigation systems also are suitable. For the efficient application and removal of surface irrigation water, land leveling is needed. Because of the slow permeability, water applications should be regulated so that the water does not stand on the surface and damage the crop. Land smoothing and open ditches can reduce surface wetness. The use of pipe, ditch lining, or drop structures in irrigation ditches reduces water loss and the hazard of erosion.

Solid-set sprinkler irrigation is the best method of controlling frost and providing adequate moisture for tree fruit. Compaction can be minimized by limiting the use of equipment when the soil is wet. A permanent cover crop helps to control runoff and erosion.

This unit is well suited to permanent pasture. The high content of clay limits tillage and root growth. Deep cracks form as the soil dries in summer. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

The main limitations affecting homesite development are the slow permeability, a high shrink-swell potential, the depth to bedrock, and low strength.

This unit is poorly suited to standard systems of waste disposal because of the slow permeability and the depth to bedrock. Alternative waste disposal systems may function properly on this unit. Suitable included soils are throughout the unit. Onsite investigation is needed to locate such soils.

If buildings are constructed on this unit, properly designing foundations and footings, diverting runoff away from the buildings, and backfilling with material that has a low shrink-swell potential help to prevent the structural damage caused by shrinking and swelling. Properly designing buildings and roads helps to offset the limited ability of the soil to support a load.

Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. In many areas it may be necessary to haul in topsoil for lawns and gardens. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

The main limitations affecting livestock grazing are compaction, the clayey surface layer, and droughtiness. The vegetation suitable for grazing includes Idaho fescue, California brome, and prairie junegrass. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment.

Range seeding is suitable if the site is in poor condition. The main limitations are the clayey surface layer and droughtiness. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the depth to bedrock.

The vegetative site is Droughty North, 18- to 35-inch precipitation zone.

43D—Darow silty clay loam, 5 to 20 percent slopes. This moderately deep, moderately well drained soil is on hillslopes. It formed in colluvium and residuum derived dominantly from siltstone. Elevation is 1,200 to 3,000 feet. The mean annual precipitation is 18 to 30 inches, the mean annual temperature is 52 to 54 degrees F, and the average frost-free period is 120 to 180 days. The native vegetation is mainly hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is dark brown silty clay loam about 12 inches thick. The subsoil is dark brown and dark yellowish brown silty clay about 20 inches thick. Weathered bedrock is at a depth of about 32 inches. The depth to bedrock ranges from 20 to 40 inches.

Included in this unit are small areas of Brader and Debenger soils on ridges and convex slopes; Carney, Coker, and Selmac soils on concave slopes; Cove, Gregory, and Padigan soils near drainageways; Manita soils; and soils that are similar to the Darow soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Darow soils that have slopes of less than 5 or more than 20 percent. Included areas make up about 20 percent of the total acreage.

Permeability is slow in the Darow soil. Available water capacity is about 5 inches. The effective rooting depth is 20 to 40 inches. Runoff is slow or medium, and the hazard of water erosion is slight or moderate. The water table fluctuates between depths of 3.0 and 3.5 feet from December through April.

This unit is used mainly for hay and pasture or for tree fruit. It also is used for homesite development and livestock grazing.

This unit is suited to irrigated crops. It is limited mainly by the high content of clay, a slow rate of water intake, and droughtiness. In summer, irrigation is needed for the maximum production of most crops. Because of the slope, sprinkler and trickle irrigation systems are the best methods of applying water. These systems permit an even, controlled application of water, help to prevent excessive runoff, and minimize the risk of erosion. To prevent overirrigation and excessive erosion, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop.

Solid-set sprinkler irrigation is the best method of controlling frost and providing adequate moisture for tree fruit. Compaction can be minimized by limiting the use of equipment when the soil is wet. A permanent cover crop helps to control runoff and erosion.

This unit is well suited to permanent pasture. The high content of clay limits tillage and root growth. Deep cracks form as the soil dries in summer. Seedbeds should be prepared on the contour or across the slope where practical. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

The main limitations affecting homesite development are the slow permeability, a high shrink-swell potential, the slope, the depth to bedrock, and low strength.

This unit is poorly suited to standard systems of waste disposal because the slow permeability and the depth to bedrock. Alternative waste disposal systems may function properly on this unit. Suitable included soils are throughout the unit. Onsite investigation is needed to locate such soils.

If buildings are constructed on this unit, properly designing foundations and footings, diverting runoff away from the buildings, and backfilling with material that has a low shrink-swell potential help to prevent the structural damage caused by shrinking and swelling. Properly designing buildings and roads helps to offset the limited ability of the soil to support a load.

Erosion is a hazard on the steeper slopes. Only the part of the site that is used for construction should be disturbed. Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. In many areas it may be necessary to haul in topsoil for lawns and gardens. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

The main limitations affecting livestock grazing are compaction, erosion, the clayey surface layer, and droughtiness. The vegetation suitable for grazing includes Idaho fescue, California brome, and prairie junegrass. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment.

Range seeding is suitable if the site is in poor condition. The main limitations are the clayey surface layer and droughtiness. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the slope and the depth to bedrock.

The vegetative site is Droughty North, 18- to 35-inch precipitation zone.

43E—Darow silty clay loam, 20 to 35 percent slopes. This moderately deep, moderately well drained soil is on hillslopes. It formed in colluvium derived dominantly from siltstone. Elevation is 1,200 to 3,000 feet. The mean annual precipitation is 18 to 30 inches, the mean annual temperature is 52 to 54 degrees F, and the average frost-free period is 120 to 180 days. The native vegetation is mainly hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is dark brown silty clay loam about 12 inches thick. The subsoil is dark brown and dark yellowish brown silty clay about 20 inches thick. Weathered bedrock is at a depth of about 32 inches. The depth to bedrock ranges from 20 to 40 inches.

Included in this unit are small areas of Rock outcrop and Brader and Debenger soils on ridges and convex slopes; Carney, Coker, and Selmac soils on concave slopes; Cove, Gregory, and Padigan soils near drainageways; Manita soils; and soils that are similar to the Darow soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Darow soils that have slopes of less than 20 or more than 35 percent. Included areas make up about 20 percent of the total acreage.

Permeability is slow in the Darow soil. Available water capacity is about 5 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate. The water table fluctuates between depths of 3.0 and 3.5 feet from December through April.

This unit is used mainly for homesite development or livestock grazing. It also is used for tree fruit.

The main limitations affecting homesite development are the slow permeability, a high shrink-swell potential, the slope, the depth to bedrock, and low strength.

This unit is poorly suited to standard systems of waste disposal because of the slow permeability, the depth to bedrock, and the slope. Alternative waste disposal systems may function properly on this unit. Suitable included soils are throughout the unit. Onsite investigation is needed to locate such soils.

The slope limits the use of the steeper areas of this unit for building site development. Cuts needed to provide essentially level building sites can expose bedrock. Properly designing foundations and footings, diverting runoff away from the buildings, and backfilling with material that has a low shrink-swell potential help to prevent the structural damage caused by shrinking and swelling. Properly designing buildings and roads helps to offset the limited ability of the soil to support a load.

Erosion is a hazard on the steeper slopes. Only the part of the site that is used for construction should be disturbed. Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. In many areas it may be necessary to haul in topsoil for lawns and gardens. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

The main limitations affecting livestock grazing are compaction, erosion, the clayey surface layer, droughtiness, and the slope. The vegetation suitable for grazing includes Idaho fescue, California brome, and prairie junegrass. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment. In places the use of ground equipment and access by livestock are limited by the slope.

Range seeding is suitable if the site is in poor condition. The main limitations are the clayey surface layer, the slope, and droughtiness. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the slope and the depth to bedrock.

Solid-set sprinkler irrigation is the best method of controlling frost and providing adequate moisture for tree fruit. Compaction can be minimized by limiting the use of equipment when the soils are wet. A permanent cover crop helps to control runoff and erosion.

The vegetative site is Droughty North, 18- to 35-inch precipitation zone.

44C—Debenger-Brader loams, 1 to 15 percent slopes. This map unit is on knolls and ridges. Elevation is 1,000 to 3,500 feet. The mean annual precipitation is 18 to 35 inches, the mean annual temperature is 50 to 54 degrees F, and the average frost-free period is 150 to 180 days. The native vegetation is mainly hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 60 percent Debenger soil and 20 percent Brader soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Rock outcrop on convex slopes; Carney, Coker, and Darow soils on concave slopes; poorly drained soils that are similar to the Debenger soil; Padigan soils near drainageways; Langellain and Ruch soils; and soils that are similar to the Brader soil but have bedrock within a depth of 12 inches. Also included are small areas of Debenger and Brader soils that have slopes of more than 15 percent. Included areas make up about 20 percent of the total acreage.

The Debenger soil is moderately deep and well drained. It formed in colluvium derived dominantly from sandstone. Typically, the surface layer is dark brown loam about 5 inches thick. The next layer is reddish brown loam about 4 inches thick. The subsoil is reddish brown and yellowish red clay loam about 18 inches thick. Weathered bedrock is at a depth of about 27 inches. The depth to bedrock ranges from 20 to 40 inches.

Permeability is moderate in the Debenger soil. Available water capacity is about 5 inches. The effective rooting depth is 20 to 40 inches. Runoff is slow or medium, and the hazard of water erosion is slight or moderate.

The Brader soil is shallow and well drained. It formed in colluvium derived dominantly from sandstone. Typically, the surface layer is dark brown loam about 6 inches thick. The subsoil is dark reddish brown loam about 7 inches thick. Weathered bedrock is at a depth of about 13 inches. The depth to bedrock ranges from 12 to 20 inches.

Permeability is moderate in the Brader soil. Available water capacity is about 2 inches. The effective rooting depth is 12 to 20 inches. Runoff is slow or medium, and the hazard of water erosion is slight or moderate.

This unit is used for hay and pasture, livestock grazing, and homesite development.

This unit is suited to irrigated hay and pasture. It is limited mainly by the depth to bedrock in the Brader soil and droughtiness in both soils. In summer, irrigation is needed for the maximum production of most forage crops. Sprinkler irrigation is the best method of applying water. This method permits an even, controlled application of water, helps to prevent excessive runoff, and minimizes the risk of erosion. Border and contour flood irrigation systems also are suitable in the less sloping areas. For the efficient application and removal of surface irrigation water, land leveling is needed. The bedrock underlying the Brader soil, however, may be exposed. To prevent overirrigation and excessive erosion, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop.

Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soils from erosion. Grazing when the soils are wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

The main limitations affecting livestock grazing are compaction, erosion, droughtiness, and the depth to bedrock in the Brader soil. The vegetation suitable for grazing includes Idaho fescue, bluebunch wheatgrass, and pine bluegrass. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Grazing should be delayed until the soils are firm and the more desirable forage plants have achieved enough growth to withstand grazing pressure.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment.

Range seeding is suitable if the site is in poor condition. The main limitations are the depth to bedrock in the Brader soil and droughtiness in both soils. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the depth to bedrock.

The main limitation affecting homesite development is the depth to bedrock.

This unit is poorly suited to septic tank absorption fields because of the depth to bedrock. The absorption fields can be installed in areas of the unit where the bedrock is at a greater depth. Onsite investigation is needed to locate such areas.

Cuts needed to provide essentially level building sites can expose bedrock. Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. In many areas it may be necessary to haul in topsoil for lawns and gardens. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

The vegetative site in areas of the Debenger soil is Loamy Slopes, 18- to 24-inch precipitation zone, and the one in areas of the Brader soil is Loamy Hills, 20- to 35-inch precipitation zone.

44E—Debenger-Brader loams, 15 to 40 percent slopes. This map unit is on knolls and ridges. Elevation is 1,000 to 3,500 feet. The mean annual precipitation is 18 to 35 inches, the mean annual temperature is 50 to 54 degrees F, and the average frost-free period is 150 to 180 days. The native vegetation is mainly hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 55 percent Debenger soil and 20 percent Brader soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Rock outcrop on convex slopes, Carney and Darow soils on concave slopes, Padigan soils near drainageways, Heppsie soils on the steeper parts of the landscape, and Langellain and Ruch soils. Also included are small areas of soils that are similar to the Debenger and Brader soils but have more than 35 percent rock fragments, soils that are similar to the Brader soil but have bedrock within a depth of 12 inches, and Debenger and Brader soils that have slopes of less than 15 or more than 40 percent. Included areas make up about 25 percent of the total acreage.

The Debenger soil is moderately deep and well drained. It formed in colluvium derived dominantly from sandstone. Typically, the surface layer is dark brown loam about 5 inches thick. The next layer is reddish brown loam about 4 inches thick. The subsoil is reddish brown and yellowish red clay loam about 18 inches thick. Weathered bedrock is at a depth of about 27 inches. The depth to bedrock ranges from 20 to 40 inches.

Permeability is moderate in the Debenger soil. Available water capacity is about 5 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium or rapid, and the hazard of water erosion is moderate or high.

The Brader soil is shallow and well drained. It formed in colluvium derived dominantly from sandstone. Typically, the surface layer is dark brown loam about 6 inches thick. The subsoil is dark reddish brown loam about 7 inches thick. Weathered bedrock is at a depth of about 13 inches. The depth to bedrock ranges from 12 to 20 inches.

Permeability is moderate in the Brader soil. Available water capacity is about 2 inches. The effective rooting depth is 12 to 20 inches. Runoff is medium or rapid, and the hazard of water erosion is moderate or high.

This unit is used mainly for livestock grazing or homesite development. Some of the less sloping areas are used for hay and pasture.

The main limitations affecting livestock grazing are compaction, erosion, droughtiness, the slope, and the depth to bedrock in the Brader soil. The vegetation suitable for grazing includes Idaho fescue, bluebunch wheatgrass, and pine bluegrass. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment. In places the use of ground equipment and access by livestock are limited by the slope. Constructing trails or walkways allows livestock to graze in areas where access is limited.

Range seeding is suitable if the site is in poor condition. The main limitations are the depth to bedrock in the Brader soil, droughtiness, and the slope. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the slope and the depth to bedrock.

The main limitations affecting homesite development are the depth to bedrock and the slope. The slope limits the use of the steeper areas of this unit for building site development. Cuts needed to provide essentially level building sites can expose bedrock. Erosion is a hazard on the steeper slopes. Only the part of the site that is used for construction should be disturbed.

This unit is poorly suited to septic tank absorption fields because of the depth to bedrock and the slope. The absorption fields can be installed in areas of the unit where the soils are deeper over bedrock and are less sloping. Onsite investigation is needed to locate such areas.

Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. In many areas it may be necessary to haul in topsoil for lawns and gardens. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

The vegetative site in areas of the Debenger soil is Loamy Slopes, 18- to 24-inch precipitation zone, and the one in areas of the Brader soil is Loamy Hills, 20- to 35-inch precipitation zone.

45G—Donegan gravelly loam, 35 to 65 percent north slopes. This moderately deep, well drained soil is on hillslopes. It formed in colluvium derived from andesite and volcanic ash. Elevation is 4,000 to 5,100 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 41 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about 3 inches thick. The surface layer is dark brown gravelly loam about 10 inches thick. The next 12 inches also is dark brown gravelly loam. The subsoil is dark brown extremely gravelly loam about 10 inches thick. Weathered bedrock is at a depth of about 32 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Included in this unit are small areas of Killet soils on concave slopes, soils that are similar to Killet soils but have bedrock within a depth of 60 inches, Rock outcrop on convex slopes, and soils that are similar to the Donegan soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Donegan soils that have slopes of less than 35 or more than 65 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately slow in the Donegan soil. Available water capacity is about 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and white fir. Other species that grow on this unit include incense cedar, western hemlock, and Pacific dogwood. The understory vegetation includes cascade Oregongrape, vine maple, and deerfoot vanillaleaf.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 140. The yield at culmination of the mean annual increment is 8,700 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 69,410 board feet per acre (Scribner rule) at 110 years. On the basis of a 50-year curve, the mean site index is 105.

On the basis of a 50-year site curve, the mean site index for white fir is 85. The yield at culmination of the mean annual increment is 14,420 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years.

The main limitations affecting timber production are the slope, erosion, compaction, plant competition, and seedling mortality. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Building the roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting ponderosa pine and Douglas fir seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

Severe frost can damage or kill seedlings. Proper timber harvesting methods can reduce the effect of frost on regeneration.

The main limitations affecting livestock grazing are erosion, compaction, and the slope. The native vegetation suitable for grazing includes western fescue, mountain brome, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Western Hemlock Forest.

46G—Donegan gravelly loam, 35 to 65 percent south slopes. This moderately deep, well drained soil is on hillslopes. It formed in colluvium derived from igneous rock and volcanic ash. Elevation is 4,000 to 5,100 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 41 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about 3 inches thick. The surface layer is dark brown gravelly loam about 10 inches thick. The next 12 inches also is dark brown gravelly loam. The subsoil is dark brown extremely gravelly loam about 10 inches thick. Weathered bedrock is at a depth of about 32 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Included in this unit are small areas of Killet soils on concave slopes, soils that are similar to Killet soils but have bedrock within a depth of 60 inches, Rock outcrop on convex slopes, and soils that are similar to the Donegan soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Donegan soils that have slopes of less than 35 or more than 65 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately slow in the Donegan soil. Available water capacity is about 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and white fir. Other species that grow on this unit include incense cedar, sugar pine, and Pacific madrone. The understory vegetation includes Whipplevine, Pacific serviceberry, and tall Oregon grape.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 130. The yield at culmination of the mean annual increment is 7,740 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 58,520 board feet per acre (Scribner rule) at 110 years. On the basis of a 50-year curve, the mean site index is 95.

On the basis of a 50-year site curve, the mean site index for white fir is 80. The yield at culmination of the mean annual increment is 13,720 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years.

The main limitations affecting timber production are the slope, erosion, compaction, plant competition, and seedling mortality. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Building the roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial

reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting ponderosa pine and Douglas fir seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. The large number of rock fragments in the soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced by providing artificial shade for seedlings.

Severe frost can damage or kill seedlings. Proper timber harvesting methods can reduce the effect of frost on regeneration.

The main limitations affecting livestock grazing are erosion, compaction, and the slope. The native vegetation suitable for grazing includes western fescue, tall trisetum, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Mixed Pine Forest.

47C—Donegan-Killet gravelly loams, 3 to 12 percent slopes. This map unit is on plateaus. Elevation is 4,000 to 5,100 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 41 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

This unit is about 60 percent Donegan soil and 20 percent Killet soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of poorly drained soils near drainageways and on concave slopes, soils that are similar to the Killet soil but have bedrock within a depth of 60 inches, and soils that are similar to the Donegan soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Donegan and Killet soils that have slopes of less than 3 or more than 12 percent. Included areas make up about 20 percent of the total acreage.

The Donegan soil is moderately deep and well drained. It formed in colluvium derived dominantly from andesite and volcanic ash. Typically, the surface is covered with a layer of needles, leaves, and twigs about 3 inches thick. The surface layer is dark brown gravelly loam about 10 inches thick. The next 12 inches also is dark brown gravelly loam. The subsoil is dark brown extremely gravelly loam about 10 inches thick. Weathered bedrock is at a depth of about 32 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Permeability is moderately slow in the Donegan soil. Available water capacity is about 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is slow, and the hazard of water erosion is slight.

The Killet soil is very deep and well drained. It formed in colluvium derived dominantly from andesite and volcanic ash. Typically, the surface is covered with a layer of needles, leaves, and twigs about 2 inches thick. The surface layer is dark reddish brown gravelly loam about 18 inches thick. The upper 20 inches of the subsoil is dark reddish brown gravelly clay loam. The lower 22 inches is dark reddish brown clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is stony.

Permeability is moderately slow in the Killet soil. Available water capacity is about 9 inches. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and white fir. Other species that grow on this unit include incense cedar, western hemlock, and Pacific dogwood. The understory vegetation includes cascade Oregongrape, vine maple, and deerfoot vanillaleaf.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 140 on the Donegan soil. The yield at culmination of the mean annual increment is 8,700 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 69,410 board feet per acre (Scribner rule) at 110 years. On the basis of a 50-year curve, the mean site index is 105.

On the basis of a 50-year site curve, the mean site index for white fir is 85 on the Donegan soil. The yield at culmination of the mean annual increment is 14,420 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 150 on the Killet soil. The yield at culmination of the mean annual increment is 9,480 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 72,400 board feet per acre (Scribner rule) at 100 years. On the basis of a 50-year curve, the mean site index is 115.

On the basis of a 50-year site curve, the mean site index for white fir is 90 on the Killet soil. The yield at culmination of the mean annual increment is 15,190 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years.

The main limitations affecting timber production are compaction, erosion, plant competition, and seedling mortality. Also, the bedrock underlying the Donegan soil restricts root growth. As a result, windthrow is a hazard.

Conventional methods of harvesting timber generally are suitable, but the soils may be compacted if they are moist when heavy equipment is used. Puddling can occur when the soils are wet. If the soils are excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Erosion can be controlled by carefully planning the construction and maintenance of logging roads, skid trails, and landings. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting ponderosa pine and Douglas fir seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

Severe frost can damage or kill seedlings. Air drainage may be restricted on this unit. Proper timber harvesting methods can reduce the effect of frost on regeneration.

The main limitation affecting livestock grazing is compaction. The native vegetation suitable for grazing includes western fescue, mountain brome, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soils. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Western Hemlock Forest.

48E—Donegan-Killet gravelly loams, 12 to 35 percent north slopes. This map unit is on hillslopes. Elevation is 4,000 to 5,100 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 41 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

This unit is about 60 percent Donegan soil and 20 percent Killet soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of poorly drained soils near drainageways and on concave slopes, Rock outcrop on convex slopes, soils that are similar to the Killet soil but have bedrock within a depth of 60 inches, and soils that are similar to the Donegan soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Donegan and Killet soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 20 percent of the total acreage.

The Donegan soil is moderately deep and well drained. It formed in colluvium derived dominantly from andesite and volcanic ash. Typically, the surface is covered with a layer of needles, leaves, and twigs about 3 inches thick. The surface layer is dark brown gravelly loam about 10 inches thick. The next 12 inches also is dark brown gravelly loam. The subsoil is dark brown extremely gravelly loam about 10 inches thick. Weathered bedrock is at a depth of about 32 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Permeability is moderately slow in the Donegan soil. Available water capacity is about 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

The Killet soil is very deep and well drained. It formed in colluvium derived dominantly from andesite and volcanic ash. Typically, the surface is covered with a layer of needles, leaves, and twigs about 2 inches thick. The surface layer is dark reddish brown gravelly loam about 18 inches thick. The upper 20 inches of the subsoil is dark reddish brown gravelly clay loam. The lower 22 inches is dark reddish brown clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is stony.

Permeability is moderately slow in the Killet soil. Available water capacity is about 9 inches. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and white fir. Other species that grow on this unit include incense cedar, western hemlock, and Pacific dogwood. The understory vegetation includes cascade Oregongrape, vine maple, and deerfoot vanillaleaf.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 140 on the Donegan soil. The yield at culmination of the mean annual increment is 8,700 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 69,410 board feet per acre (Scribner rule) at 110 years. On the basis of a 50-year curve, the mean site index is 105.

On the basis of a 50-year site curve, the mean site index for white fir is 85 on the Donegan soil. The yield at culmination of the mean annual increment is 14,420 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 150 on the Killet soil. The yield at culmination of the mean annual increment is 9,480 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 72,400 board feet per acre (Scribner rule) at 100 years. On the basis of a 50-year curve, the mean site index is 115.

On the basis of a 50-year site curve, the mean site index for white fir is 90 on the Killet soil. The yield at culmination of the mean annual increment is 15,190 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years.

The main limitations affecting timber production are erosion, compaction, plant competition, and seedling mortality. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. If the soils are excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soils are moist causes rutting and compaction. Puddling can occur when the soils are wet. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting ponderosa pine and Douglas fir seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

Severe frost can damage or kill seedlings. In the less sloping areas where air drainage may be restricted, proper timber harvesting methods can reduce the effect of frost on regeneration.

The main limitations affecting livestock grazing are compaction and erosion. The native vegetation suitable for grazing includes western fescue, mountain brome, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soils. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Western Hemlock Forest.

49E—Donegan-Killet gravelly loams, 12 to 35 percent south slopes. This map unit is on hillslopes. Elevation is 4,000 to 5,100 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 41 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

This unit is about 60 percent Donegan soil and 20 percent Killet soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of poorly drained soils near drainageways and on concave slopes, Rock outcrop on convex slopes, soils that are similar to the Killet soil but have bedrock within a depth of 60 inches, and soils that are similar to the Donegan soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Donegan and Killet soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 20 percent of the total acreage.

The Donegan soil is moderately deep and well drained. It formed in colluvium derived dominantly from andesite and volcanic ash. Typically, the surface is covered with a layer of needles, leaves, and twigs about 3 inches thick. The surface layer is dark brown gravelly loam about 10 inches thick. The next 12 inches also is dark brown gravelly loam. The subsoil is dark brown extremely gravelly loam about 10 inches thick. Weathered bedrock is at a depth of about 32 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Permeability is moderately slow in the Donegan soil. Available water capacity is about 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

The Killet soil is very deep and well drained. It formed in colluvium derived dominantly from andesite and volcanic ash. Typically, the surface is covered with a layer of needles, leaves, and twigs about 2 inches thick. The surface layer is dark reddish brown gravelly loam about 18 inches thick. The upper 20 inches of the subsoil is dark reddish brown gravelly clay loam. The lower 22 inches is dark reddish brown clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is stony.

Permeability is moderately slow in the Killet soil. Available water capacity is about 9 inches. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and white fir. Other species that grow on this unit include incense cedar, sugar pine, and Pacific madrone. The understory vegetation includes Whipplevine, Pacific serviceberry, and tall Oregon grape.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 135 on the Donegan soil. The yield at culmination of the mean annual increment is 8,280 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 63,910 board feet per acre (Scribner rule) at 110 years. On the basis of a 50-year curve, the mean site index is 100.

On the basis of a 50-year site curve, the mean site index for white fir is 80 on the Donegan soil. The yield at culmination of the mean annual increment is 13,720 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 140 on the Killet soil. The yield at culmination of the mean annual increment is 8,700 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 69,410 board feet per acre (Scribner rule) at 110 years. On the basis of a 50-year curve, the mean site index is 105.

On the basis of a 50-year site curve, the mean site index for white fir is 85 on the Killet soil. The yield at culmination of the mean annual increment is 14,420 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years.

The main limitations affecting timber production are erosion, compaction, plant competition, and seedling mortality. Also, the bedrock underlying the Donegan soil restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. If the soils are excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soils are moist causes rutting and compaction. Puddling can occur when the soils are wet. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting ponderosa pine and Douglas fir seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. The large number of rock fragments in the Donegan soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings.

Severe frost can damage or kill seedlings. In the less sloping areas where air drainage may be restricted, proper timber harvesting methods can reduce the effect of frost on regeneration.

The main limitations affecting livestock grazing are compaction and erosion. The native vegetation suitable for grazing includes western fescue, tall trisetum, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soils. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Mixed Pine Forest.

50E—Dubakella very stony clay loam, rocky, 12 to 35 percent slopes. This moderately deep, well drained soil is on hillslopes. It formed in colluvium derived dominantly from peridotite and serpentinite. Elevation is 1,200 to 4,100 feet. The mean annual precipitation is 35 to 60 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is dark reddish brown very stony clay loam about 11 inches thick. The subsoil is dark reddish brown very cobbly clay about 20 inches thick. Bedrock is at a depth of about 31 inches. The depth to bedrock ranges from 20 to 40 inches.

Included in this unit are small areas of Pearsoll soils and Rock outcrop on ridges and convex slopes; Acker, Gravecreek, Josephine, Norling, and Speaker soils; and, on concave slopes and foot slopes, soils that are similar to the Dubakella soil but have bedrock at a depth of more than 40 inches. Also included are Dubakella soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 25 percent of the total acreage.

Permeability is slow in the Dubakella soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate or high.

This unit is used for timber production and wildlife habitat. It is poorly suited to timber production. The species that grow on this unit include Douglas fir, incense cedar, Jeffrey pine, and Pacific madrone. The understory vegetation includes canyon live oak, common snowberry, and California fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 80. The yield at culmination of the mean annual increment is 4,060 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years and 23,360 board feet per acre (Scribner rule) at 160 years. On the basis of a 50-year curve, the mean site index is 60.

The main limitations affecting timber production are low fertility, erosion, compaction, seedling mortality, and plant competition.

When timber is harvested, management that minimizes the risk of erosion is essential. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. Rock outcrop and stones can cause breakage of falling timber and can hinder yarding. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use. Cutbanks occasionally slump when the soil is saturated.

A high temperature in the surface layer during summer, the large number of rock fragments in the soil, and the low available water capacity increase the seedling mortality rate. A high content of magnesium and low content of calcium also increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. Reforestation can be accomplished by planting Jeffrey pine and incense cedar seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

Increased erosion, loss of plant nutrients, and water repellency are likely to result from fires of moderate intensity.

The vegetative site is Douglas Fir-Pine Forest, Serpentine.

50G—Dubakella very stony clay loam, rocky, 35 to 70 percent slopes. This moderately deep, well drained soil is on hillslopes. It formed in colluvium derived dominantly from peridotite and serpentinite. Elevation is 1,200 to 4,100 feet. The mean annual precipitation is 35 to 60 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is dark reddish brown very stony clay loam about 11 inches thick. The subsoil is dark reddish brown very cobbly clay about 20 inches thick. Bedrock is at a depth of about 31 inches. The depth to bedrock ranges from 20 to 40 inches.

Included in this unit are small areas of Pearsoll soils and Rock outcrop on ridges and convex slopes; Acker, Beekman, Gravecreek, Josephine, Norling, and Speaker soils; and, on concave slopes and foot slopes, soils that are similar to the Dubakella soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Dubakella soils that have slopes of less than 35 or more than 70 percent. Included areas make up about 25 percent of the total acreage.

Permeability is slow in the Dubakella soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production and wildlife habitat. It is poorly suited to timber production. The species that grow on this unit include Douglas fir, incense cedar, Jeffrey pine, and Pacific madrone. The understory vegetation includes canyon live oak, common snowberry, and California fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 80. The yield at culmination of the mean annual increment is 4,060 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years and 23,360 board feet per acre (Scribner rule) at 160 years. On the basis of a 50-year curve, the mean site index is 60.

The main limitations affecting timber production are the slope, low fertility, erosion, compaction, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

When timber is harvested, management that minimizes the risk of erosion is essential. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. Rock outcrop and stones can cause breakage of falling timber and can hinder yarding. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Building the roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer during summer, the large number of rock fragments in the soil, and the low available water capacity increase the seedling mortality rate. A high content of magnesium and low content of calcium also increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced by providing artificial shade for seedlings. Reforestation can be accomplished by planting Jeffrey pine and incense cedar seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

Increased erosion, loss of plant nutrients, and water repellency are likely to result from fires of moderate intensity.

The vegetative site is Douglas Fir-Pine Forest, Serpentine.

51C—Dumont gravelly clay loam, 1 to 12 percent slopes. This very deep, well drained soil is on foot slopes. It formed in colluvium derived dominantly from metamorphic rock. Elevation is 2,400 to 4,000 feet. The mean annual precipitation is 45 to 60 inches, the mean annual temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is dark reddish brown gravelly clay loam about 4 inches thick. The next layer is dark reddish brown clay loam about 11 inches thick. The upper 36 inches of the subsoil is yellowish red clay. The lower 9 inches is yellowish red clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is stony.

Included in this unit are small areas of Acker soils, Norling soils on the more sloping parts of the landscape and on convex slopes, and poorly drained soils near drainageways. Also included are small areas of Dumont soils that have slopes of more than 12 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderately slow in the Dumont soil. Available water capacity is about 9 inches. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir. Other species that grow on this unit include incense cedar, western hemlock, and Pacific madrone. The understory vegetation includes golden chinkapin, salal, and cascade Oregongrape.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 135. The yield at culmination of the mean annual increment is 8,280 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 63,910 board feet per acre (Scribner rule) at 110 years. On the basis of a 50-year curve, the mean site index is 100.

The main limitations affecting timber production are compaction, erosion, and plant competition. Conventional methods of harvesting timber generally are suitable, but the soil may be compacted if it is moist when heavy equipment is used. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Erosion can be controlled by carefully planning the construction and maintenance of logging roads, skid trails, and landings. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The vegetative site is Mixed Fir-Salal (rhododendron) Forest.

52C—Dumont-Coyata gravelly loams, 1 to 12 percent slopes. This map unit is on plateaus. Elevation is 2,000 to 4,000 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 50 percent Dumont soil and 35 percent Coyata soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Reinecke soils, Terrabella soils near drainageways and on concave slopes, and soils that are similar to the Dumont soil but have more than 35 percent rock fragments or have bedrock within a depth of 60 inches. Also included are small areas of Dumont and Coyata soils that have slopes of more than 12 percent. Included areas make up about 15 percent of the total acreage.

The Dumont soil is very deep and well drained. It formed in residuum and colluvium derived dominantly from andesite. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1½ inches thick. The surface layer is dark reddish brown gravelly loam about 9 inches thick. The next layer is dark reddish brown clay loam about 9 inches thick. The subsoil is dark reddish brown clay about 42 inches thick. The depth to bedrock is 60 inches or more. In some areas the surface layer is cobbly or stony.

Permeability is moderately slow in the Dumont soil. Available water capacity is about 9 inches. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

The Coyata soil is moderately deep and well drained. It formed in colluvium derived dominantly from andesite. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1½ inches thick. The surface layer is dark reddish brown gravelly loam about 11 inches thick. The next layer is dark brown very cobbly clay loam about 10 inches thick. The subsoil is dark brown extremely cobbly clay loam about 10 inches thick. Bedrock is at a depth of about 31 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is cobbly or stony.

Permeability is moderate in the Coyata soil. Available water capacity is about 2 inches. The effective rooting depth is 20 to 40 inches. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir. Other species that grow on this unit include white fir, western hemlock, and golden chinkapin. The understory vegetation includes vine maple, California hazel, and cascade Oregongrape.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 140 on the Dumont soil. The yield at culmination of the mean annual increment is 8,700 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 69,410 board feet per acre (Scribner rule) at 110 years. On the basis of a 50-year curve, the mean site index is 105.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 130 on the Coyata soil. The yield at culmination of the mean annual increment is 7,740 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 58,520 board feet per acre (Scribner rule) at 110 years. On the basis of a 50-year curve, the mean site index is 100.

The main limitations affecting timber production are compaction, erosion, plant competition, and seedling mortality. Also, the bedrock underlying the Coyata soil restricts root growth. As a result, windthrow is a hazard.

Conventional methods of harvesting timber generally are suitable, but the soils may be compacted if they are moist when heavy equipment is used. Puddling can occur when the soils are wet. If the soils are excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction.

Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Erosion can be controlled by carefully planning the construction and maintenance of logging roads, skid trails, and landings. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. The large number of rock fragments in the Coyata soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings.

Severe frost can damage or kill seedlings. Air drainage may be restricted on this unit. Proper timber harvesting methods can reduce the effect of frost on regeneration.

The main limitation affecting livestock grazing is compaction. The native vegetation suitable for grazing includes western fescue, mountain brome, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soils. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Western Hemlock Forest.

53E—Dumont-Coyata gravelly loams, 12 to 35 percent north slopes. This map unit is on hillslopes. Elevation is 2,000 to 4,000 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 55 percent Dumont soil and 25 percent Coyata soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Reinecke soils, Alcot and Crater Lake soils on concave slopes, Terrabella soils near drainageways and on concave slopes, Rock outcrop on ridges and convex slopes, and soils that are similar to the Dumont soil but have more than 35 percent rock fragments or have bedrock within a depth of 60 inches. Also included are small areas of Dumont and Coyata soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 20 percent of the total acreage.

The Dumont soil is very deep and well drained. It formed in colluvium derived dominantly from andesite. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1½ inches thick. The surface layer is dark reddish brown gravelly loam about 9 inches thick. The next layer is dark reddish brown clay loam about 9 inches thick. The subsoil is dark reddish brown clay about 42 inches thick. The depth to bedrock is 60 inches or more. In some areas the surface layer is cobbly or stony.

Permeability is moderately slow in the Dumont soil. Available water capacity is about 9 inches. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

The Coyata soil is moderately deep and well drained. It formed in colluvium derived dominantly from andesite. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1½ inches thick. The surface layer is dark reddish brown gravelly loam about 11 inches thick. The next layer is dark brown very cobbly clay loam about 10 inches thick. The subsoil is dark brown extremely cobbly clay loam about 10 inches thick. Bedrock is at a depth of about 31 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is cobbly or stony.

Permeability is moderate in the Coyata soil. Available water capacity is about 2 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir.

Other species that grow on this unit include white fir, western hemlock, and golden chinkapin. The understory vegetation includes vine maple, California hazel, and cascade Oregongrape.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 140 on the Dumont soil. The yield at culmination of the mean annual increment is 8,700 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 69,410 board feet per acre (Scribner rule) at 110 years. On the basis of a 50-year curve, the mean site index is 105.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 130 on the Coyata soil. The yield at culmination of the mean annual increment is 7,740 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 58,520 board feet per acre (Scribner rule) at 110 years. On the basis of a 50-year curve, the mean site index is 100.

The main limitations affecting timber production are erosion, compaction, plant competition, and seedling mortality. Also, the bedrock underlying the Coyata soil restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. If the soils are excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soils are moist causes rutting and compaction. Puddling can occur when the soils are wet. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. The large number of rock fragments in the Coyata soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings.

The main limitations affecting livestock grazing are compaction and erosion. The native vegetation suitable for grazing includes western fescue, mountain brome, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soils. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Western Hemlock Forest.

53G—Dumont-Coyata gravelly loams, 35 to 60 percent north slopes. This map unit is on hillslopes. Elevation is 2,000 to 4,000 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 50 percent Dumont soil and 35 percent Coyata soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Rock outcrop on ridges and convex slopes and soils that are similar to the Dumont soil but have more than 35 percent rock fragments or have bedrock within a depth of 60 inches. Also included are small areas of Dumont and Coyata soils that have slopes of less than 35 or more than 60 percent. Included areas make up about 15 percent of the total acreage.

The Dumont soil is very deep and well drained. It formed in colluvium derived dominantly from andesite. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1½ inches thick. The surface layer is dark reddish brown gravelly loam about 9 inches thick. The next layer is dark reddish brown clay loam about 9 inches thick. The subsoil is dark reddish brown clay about 42 inches thick. The depth to bedrock is 60 inches or more. In some areas the surface layer is cobbly or stony.

Permeability is moderately slow in the Dumont soil. Available water capacity is about 9 inches. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

The Coyata soil is moderately deep and well drained. It formed in colluvium derived dominantly from andesite. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1½ inches thick. The surface layer is dark reddish brown gravelly loam about 11 inches thick. The next layer is dark brown very cobbly clay loam about 10 inches thick. The subsoil is dark brown extremely cobbly clay loam about 10 inches thick. Bedrock is at a depth of about 31 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is cobbly or stony.

Permeability is moderate in the Coyata soil. Available water capacity is about 2 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir. Other species that grow on this unit include white fir, western hemlock, and golden chinkapin. The understory vegetation includes vine maple, California hazel, and cascade Oregongrape.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 140 on the Dumont soil. The yield at culmination of the mean annual increment is 8,700 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 69,410 board feet per acre (Scribner rule) at 110 years. On the basis of a 50-year curve, the mean site index is 105.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 130 on the Coyata soil. The yield at culmination of the mean annual increment is 7,740 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 58,520 board feet per acre (Scribner rule) at 110 years. On the basis of a 50-year curve, the mean site index is 100.

The main limitations affecting timber production are the slope, erosion, compaction, plant competition, and seedling mortality. Also, the bedrock underlying the Coyata soil restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. If the soils are excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soils are moist causes rutting and compaction. Puddling can occur when the soils are wet. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soils are saturated.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Building the roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. The large number of rock fragments in the Coyata soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings.

The main limitations affecting livestock grazing are erosion, compaction, and the slope. The native vegetation suitable for grazing includes western fescue, mountain brome, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soils. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Western Hemlock Forest.

54E—Dumont-Coyata gravelly loams, 12 to 35 percent south slopes. This map unit is on hillslopes. Elevation is 2,000 to 4,000 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 50 percent Dumont soil and 30 percent Coyata soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Reinecke soils, Alcot and Crater Lake soils on concave slopes, Terrabella soils near drainageways and on concave slopes, Rock outcrop on ridges and convex slopes, and soils that are similar to the Dumont soil but have more than 35 percent rock fragments or have bedrock within a depth of 60 inches. Also included are small areas of Dumont and Coyata soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 20 percent of the total acreage.

The Dumont soil is very deep and well drained. It formed in colluvium derived dominantly from andesite. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1½ inches thick. The surface layer is dark reddish brown gravelly loam about 9 inches thick. The next layer is dark reddish brown clay loam about 9 inches thick. The subsoil is dark reddish brown clay about 42 inches thick. The depth to bedrock is 60 inches or more. In some areas the surface layer is cobbly or stony.

Permeability is moderately slow in the Dumont soil. Available water capacity is about 9 inches. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

The Coyata soil is moderately deep and well drained. It formed in colluvium derived dominantly from andesite. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1½ inches thick. The surface layer is dark reddish brown gravelly loam about 11 inches thick. The next layer is dark brown very cobbly clay loam about 10 inches thick. The subsoil is dark brown extremely cobbly clay loam about 10 inches thick. Bedrock is at a depth of about 31 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is cobbly or stony.

Permeability is moderate in the Coyata soil. Available water capacity is about 2 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir. Other species that grow on this unit include white fir, ponderosa pine, sugar pine, and Pacific madrone. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 135 on the Dumont soil. The yield at culmination of the mean annual increment is 8,280 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 63,910 board feet per acre (Scribner rule) at 110 years. On the basis of a 50-year curve, the mean site index is 105.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 120 on the Coyata soil. The yield at culmination of the mean annual increment is 6,900 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 52,440 board feet per acre (Scribner rule) at 120 years. On the basis of a 50-year curve, the mean site index is 90.

The main limitations affecting timber production are erosion, compaction, seedling mortality, and plant competition. Also, the bedrock underlying the Coyata soil restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. If the soils are excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soils are moist causes rutting and compaction. Puddling can occur when the soils are wet. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. The large number of rock fragments in the Coyata soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The main limitations affecting livestock grazing are compaction and erosion. The native vegetation suitable for grazing includes western fescue, tall trisetum, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soils. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Mixed Pine Forest.

54G—Dumont-Coyata gravelly loams, 35 to 60 percent south slopes. This map unit is on hillslopes. Elevation is 2,000 to 4,000 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 50 percent Dumont soil and 35 percent Coyata soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Rock outcrop on ridges and convex slopes and soils that are similar to the Dumont soil but have more than 35 percent rock fragments or have bedrock within a depth of 60 inches. Also included are small areas of Dumont and Coyata soils that have slopes of less than 35 or more than 60 percent. Included areas make up about 15 percent of the total acreage.

The Dumont soil is very deep and well drained. It formed in colluvium derived dominantly from andesite. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1½ inches thick. The surface layer is dark reddish brown gravelly loam about 9 inches thick. The next layer is dark reddish brown clay loam about 9 inches thick. The subsoil is dark reddish brown clay about 42 inches thick. The depth to bedrock is 60 inches or more. In some areas the surface layer is cobbly or stony.

Permeability is moderately slow in the Dumont soil. Available water capacity is about 9 inches. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

The Coyata soil is moderately deep and well drained. It formed in colluvium derived dominantly from andesite. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1½ inches thick. The surface layer is dark reddish brown gravelly loam about 11 inches thick. The next layer is dark brown very cobbly clay loam about 10 inches thick. The subsoil is dark brown extremely cobbly clay loam about 10 inches thick. Bedrock is at a depth of about 31 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is cobbly or stony.

Permeability is moderate in the Coyata soil. Available water capacity is about 2 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir. Other species that grow on this unit include white fir, ponderosa pine, sugar pine, and Pacific madrone. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 135 on the Dumont soil. The yield at culmination of the mean annual increment is 8,280 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 63,910 board feet per acre (Scribner rule) at 110 years. On the basis of a 50-year curve, the mean site index is 105.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 120 on the Coyata soil. The yield at culmination of the mean annual increment is 6,900 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 52,440 board feet per acre (Scribner rule) at 120 years. On the basis of a 50-year curve, the mean site index is 90.

The main limitations affecting timber production are the slope, erosion, compaction, seedling mortality, and plant competition. Also, the bedrock underlying the Coyata soil restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. If the soils are excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soils are moist causes rutting and compaction. Puddling can occur when the soils are wet. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soils are saturated.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Building the roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. The large number of rock fragments in the Coyata soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced by providing artificial shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The main limitations affecting livestock grazing are erosion, compaction, and the slope. The native vegetation suitable for grazing includes western fescue, tall trisetum, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soils. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Mixed Pine Forest.

55A—Evans loam, 0 to 3 percent slopes. This very deep, well drained soil is on flood plains. It formed in alluvium derived from mixed sources. Elevation is 1,000 to 3,000 feet. The mean annual precipitation is 18 to 40 inches, the mean annual temperature is 50 to 54 degrees F, and the average frost-free period is 150 to 180 days. The vegetation in areas that have not been cultivated is mainly hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is very dark brown loam about 38 inches thick. The substratum to a depth of 60 inches is dark brown loam. In some areas the surface layer is gravelly or cobbly.

Included in this unit are small areas of Abin, Camas, and Newberg soils and Riverwash; Cove soils on concave slopes; Central Point, Medford, and Takilma soils on terraces; and soils that are similar to the Evans soil but have a gravelly or very gravelly substratum. Also included are small areas of Evans soils that have slopes of more than 3 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderate in the Evans soil. Available water capacity is about 11 inches. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. This soil is occasionally flooded for brief periods from December through March.

This unit is used mainly for irrigated crops, such as alfalfa hay and small grain. Other crops include corn for silage and tree fruit. Some areas are used for grass-legume hay, pasture, or homesite development.

This unit is well suited to irrigated crops. It is limited mainly by the hazard of flooding. This hazard can be reduced by levees, dikes, and diversions.

In summer, irrigation is needed for the maximum production of most crops. Furrow, border, corrugation, trickle, and sprinkler irrigation systems are suitable. The system used generally is governed by the crop that is grown. For the efficient application and removal of surface irrigation water, land leveling is needed. To prevent overirrigation and the leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. Because the soil is droughty, the applications should be light and frequent. The use of pipe, ditch lining, or drop structures in irrigation ditches reduces water loss and the hazard of erosion.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Leaving crop residue on or near the surface helps to conserve moisture and control erosion.

A tillage pan forms easily if the soil is tilled when wet. Chiseling or subsoiling breaks up the pan. Surface crusting and compaction can be minimized by returning crop residue to the soil.

Solid-set sprinkler irrigation is the best method of controlling frost and providing adequate moisture for tree fruit. Compaction can be minimized by limiting the use of equipment when the soil is wet and by planting a cover crop. A permanent sod crop helps to control runoff.

Maintaining a protective plant cover in winter reduces the soil loss resulting from flooding. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

The main hazard affecting homesite development is the flooding, which limits the suitability for septic tank absorption fields. Alternative waste disposal systems may function properly on this unit. Suitable included soils are throughout the unit. Onsite investigation is needed to locate such soils. Dikes and channels that have outlets for floodwater can protect buildings and onsite sewage disposal systems from flooding.

Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

Roads and streets should be constructed above the expected level of flooding. The risk of flooding has been reduced in some areas by the construction of large dams and reservoirs upstream.

The vegetative site is Loamy Flood Plain, 18- to 30-inch precipitation zone.

56C—Farva very cobbly loam, 3 to 12 percent slopes. This moderately deep, well drained soil is on plateaus. It formed in colluvium derived from andesite, basalt, and volcanic ash. Elevation is 3,600 to 6,100 feet. The mean annual precipitation is 30 to 55 inches, the mean annual temperature is 40 to 45 degrees F, and the average frost-free period is less than 100 days.

The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about ½ inch thick. The surface layer is dark brown very cobbly loam about 12 inches thick. The subsoil is brown extremely cobbly loam about 15 inches thick. The substratum also is brown extremely cobbly loam. It is about 8 inches thick. Weathered bedrock is at a depth of about 35 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Included in this unit are small areas of Kanutchan and Sibannac soils in basins and near drainageways; Bybee, Pinehurst, and Tatouche soils on concave slopes; Woodseye soils and Rock outcrop on convex slopes; and soils that are similar to the Farva soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Farva soils that have slopes of less than 3 or more than 12 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately rapid in the Farva soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and white fir. Other species that grow on this unit include Pacific yew. The understory vegetation includes cascade Oregongrape and American twinflower.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 105. The yield at culmination of the mean annual increment is 5,460 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 45,600 board feet per acre (Scribner rule) at 150 years. On the basis of a 50-year curve, the mean site index is 80.

On the basis of a 50-year site curve, the mean site index for white fir is 65. The yield at culmination of the mean annual increment is 10,150 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years.

The main limitations affecting timber production are compaction, erosion, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Conventional methods of harvesting timber generally are suitable, but the soil may be compacted if it is moist when heavy equipment is used. Puddling can occur when the soil is wet. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Erosion can be controlled by carefully planning the construction and maintenance of logging roads, skid trails, and landings. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Severe frost can damage or kill seedlings. Air drainage is restricted on this unit. Proper timber harvesting methods can reduce the effect of frost on regeneration. Reforestation can be accomplished by planting seedlings of frost-tolerant species, such as ponderosa pine and lodgepole pine.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The main limitation affecting livestock grazing is compaction. The native vegetation suitable for grazing includes western fescue, mountain brome, tall trisetum, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Yew Forest.

57E—Farva very cobbly loam, 12 to 35 percent north slopes. This moderately deep, well drained soil is on hillslopes. It formed in colluvium derived from andesite, basalt, and volcanic ash. Elevation is 3,600 to 6,100 feet. The mean annual precipitation is 30 to 55 inches, the mean annual temperature is 40 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about ½ inch thick. The surface layer is dark brown very cobbly loam about 12 inches thick. The subsoil is brown extremely cobbly loam about 15 inches thick. The substratum also is brown extremely cobbly loam. It is about 8 inches thick. Weathered bedrock is at a depth of about 35 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Included in this unit are small areas of Kanutchan and Sibannac soils in basins and near drainageways; Bybee, Pinehurst, and Tatouche soils on concave slopes; Woodseye soils and Rock outcrop on ridges and convex slopes; and soils that are similar to the Farva soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Farva soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately rapid in the Farva soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and white fir. Other species that grow on this unit include Pacific yew. The understory vegetation includes cascade Oregongrape, and American twinflower.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 110. The yield at culmination of the mean annual increment is 5,980 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 48,300 board feet per acre (Scribner rule) at 140 years. On the basis of a 50-year curve, the mean site index is 85.

On the basis of a 50-year site curve, the mean site index for white fir is 65. The yield at culmination of the mean annual increment is 10,150 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years.

The main limitations affecting timber production are erosion, compaction, plant competition, and seedling mortality. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting ponderosa pine and Douglas fir seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

Severe frost can damage or kill seedlings. In the less sloping areas where air drainage may be restricted, proper timber harvesting methods can reduce the effect of frost on regeneration.

The main limitations affecting livestock grazing are compaction and erosion. The native vegetation suitable for grazing includes western fescue, mountain brome, tall trisetum, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the soil is firm and the more desirable forage plants have achieved enough growth to withstand grazing pressure.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Yew Forest.

57G—Farva very cobbly loam, 35 to 65 percent north slopes. This moderately deep, well drained soil is on hillslopes. It formed in colluvium derived from andesite, basalt, and volcanic ash. Elevation is 3,600 to 6,100 feet. The mean annual precipitation is 30 to 55 inches, the mean annual temperature is 40 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about ½ inch thick. The surface layer is dark brown very cobbly loam about 12 inches thick. The subsoil is brown extremely cobbly loam about 15 inches thick. The substratum also is brown extremely cobbly loam. It is about 8 inches thick. Weathered bedrock is at a depth of about 35 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Included in this unit are small areas of Pinehurst and Tatouche soils on the less sloping parts of the landscape, Woodseye soils and Rock outcrop on ridges and convex slopes, and soils that are similar to the Farva soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Farva soils that have slopes of less than 35 or more than 65 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately rapid in the Farva soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and white fir. Other species that grow on this unit include Pacific yew. The understory vegetation includes cascade Oregongrape, and American twinflower.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 110. The yield at culmination of the mean annual increment is 5,980 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 48,300 board feet per acre (Scribner rule) at 140 years. On the basis of a 50-year curve, the mean site index is 85.

On the basis of a 50-year site curve, the mean site index for white fir is 65. The yield at culmination of the mean annual increment is 10,150 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years.

The main limitations affecting timber production are the slope, erosion, compaction, plant competition, and seedling mortality. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Building the roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting ponderosa pine and Douglas fir seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

Severe frost can damage or kill seedlings. Proper timber harvesting methods can reduce the effect of frost on regeneration.

The main limitations affecting livestock grazing are erosion, compaction, and the slope. The native vegetation suitable for grazing includes western fescue, mountain brome, tall trisetum, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Yew Forest.

58E—Farva very cobbly loam, 12 to 35 percent south slopes. This moderately deep, well drained soil is on hillslopes. It formed in colluvium derived from andesite, basalt, and volcanic ash. Elevation is 3,600 to 6,100 feet. The mean annual precipitation is 30 to 55 inches, the mean annual temperature is 40 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about ½ inch thick. The surface layer is dark brown very cobbly loam about 12 inches thick. The subsoil is brown extremely cobbly loam about 15 inches thick. The substratum also is brown extremely cobbly loam. It is about 8 inches thick. Weathered bedrock is at a depth of about 35 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Included in this unit are small areas of Kanutchan and Sibannac soils in basins and near drainageways; Bybee, Pinehurst, and Tatouche soils on concave slopes; Woodseye soils and Rock outcrop on ridges and convex slopes; and soils that are similar to the Farva soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Farva soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately rapid in the Farva soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and white fir. Other species that grow on this unit include ponderosa pine and incense cedar. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and common snowberry.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 100. The yield at culmination of the mean annual increment is 5,040 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 39,750 board feet per acre (Scribner rule) at 150 years. On the basis of a 50-year curve, the mean site index is 75.

On the basis of a 50-year site curve, the mean site index for white fir is 65. The yield at culmination of the mean annual increment is 10,150 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years.

The main limitations affecting timber production are erosion, compaction, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. The large number of rock fragments in the soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. Reforestation can be accomplished by planting ponderosa pine and Douglas fir seedlings.

Severe frost can damage or kill seedlings. In the less sloping areas where air drainage may be restricted, proper timber harvesting methods can reduce the effect of frost on regeneration.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The main limitations affecting livestock grazing are compaction and erosion. The native vegetation suitable for grazing includes western fescue, mountain brome, tall trisetum, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Serviceberry Forest.

58G—Farva very cobbly loam, 35 to 65 percent south slopes. This moderately deep, well drained soil is on hillslopes. It formed in colluvium derived from andesite, basalt, and volcanic ash. Elevation is 3,600 to 6,100 feet. The mean annual precipitation is 30 to 55 inches, the mean annual temperature is 40 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about ½ inch thick. The surface layer is dark brown very cobbly loam about 12 inches thick. The subsoil is brown extremely cobbly loam about 15 inches thick. The substratum also is brown extremely cobbly loam. It is about 8 inches thick. Weathered bedrock is at a depth of about 35 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Included in this unit are small areas of Pinehurst and Tatouche soils on the less sloping parts of the landscape, Woodseye soils and Rock outcrop on ridges and convex slopes, and soils that are similar to the Farva soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Farva soils that have slopes of less than 35 or more than 65 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately rapid in the Farva soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and white fir. Other species that grow on this unit include ponderosa pine and incense cedar. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and common snowberry.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 100. The yield at culmination of the mean annual increment is 5,040 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 39,750 board feet per acre (Scribner rule) at 150 years. On the basis of a 50-year curve, the mean site index is 70.

On the basis of a 50-year site curve, the mean site index for white fir is 65. The yield at culmination of the mean annual increment is 10,150 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years.

The main limitations affecting timber production are the slope, erosion, compaction, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding

paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Building the roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. The large number of rock fragments in the soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced by providing artificial shade for seedlings. Reforestation can be accomplished by planting ponderosa pine and Douglas fir seedlings.

Severe frost can damage or kill seedlings. Proper timber harvesting methods can reduce the effect of frost on regeneration.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The main limitations affecting livestock grazing are erosion, compaction, and the slope. The native vegetation suitable for grazing includes western fescue, mountain brome, tall trisetum, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Serviceberry Forest.

59G—Farva-Rock outcrop complex, 35 to 70 percent north slopes. This map unit is on hillslopes. Elevation is 3,600 to 6,100 feet. The mean annual precipitation is 30 to 55 inches, the mean annual temperature is 40 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

This unit is about 70 percent Farva soil and 20 percent Rock outcrop. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Pinehurst and Tatouche soils on the less sloping parts of the landscape, Woodseye soils on ridges and convex slopes, and soils that are similar to the Farva soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Farva soils that have slopes of less than 35 or more than 70 percent. Included areas make up about 10 percent of the total acreage.

The Farva soil is moderately deep and well drained. It formed in colluvium derived dominantly from andesite, basalt, and volcanic ash. Typically, the surface is covered with a layer of needles, leaves, and twigs about ½ inch thick. The surface layer is dark brown very cobbly loam about 12 inches thick. The subsoil is brown extremely cobbly loam about 15 inches thick. The substratum also is brown extremely cobbly loam. It is about 8 inches thick. Weathered bedrock is at a depth of about 35 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Permeability is moderately rapid in the Farva soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

Rock outcrop consists of areas of exposed bedrock. Runoff is very rapid in these areas.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and white fir. Other species that grow on this unit include Pacific yew. The understory vegetation includes cascade Oregongrape and American twinflower.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 110 on the Farva soil. The yield at culmination of the mean annual increment is 5,980 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 48,300 board feet per acre (Scribner rule) at 140 years. On the basis of a 50-year curve, the mean site index is 85.

On the basis of a 50-year site curve, the mean site index for white fir is 65 on the Farva soil. The yield at culmination of the mean annual increment is 10,150 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years.

The main limitations affecting timber production are the slope, the Rock outcrop, erosion, compaction, plant competition, and seedling mortality. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. The Rock outcrop can cause breakage of falling timber and can hinder yarding. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Building the roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting ponderosa pine and Douglas fir seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

Severe frost can damage or kill seedlings. Proper timber harvesting methods can reduce the effect of frost on regeneration.

The main limitations affecting livestock grazing are erosion, compaction, the slope, and the Rock outcrop. The native vegetation suitable for grazing includes western fescue, mountain brome, tall trisetum, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

Because of the slope and the Rock outcrop, areas of this unit can hinder livestock movement.

The vegetative site is Mixed Fir-Yew Forest.

60G—Farva-Rock outcrop complex, 35 to 70 percent south slopes. This map unit is on hillslopes. Elevation is 3,600 to 6,100 feet. The mean annual precipitation is 30 to 55 inches, the mean annual temperature is 40 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

This unit is about 70 percent Farva soil and 20 percent Rock outcrop. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Pinehurst and Tatouche soils on the less sloping parts of the landscape, Woodseye soils on ridges and convex slopes, and soils that are similar to the Farva soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Farva soils that have slopes of less than 35 or more than 70 percent. Included areas make up about 10 percent of the total acreage.

The Farva soil is moderately deep and well drained. It formed in colluvium derived dominantly from andesite, basalt, and volcanic ash. Typically, the surface is covered with a layer of needles, leaves, and twigs about ½ inch thick. The surface layer is dark brown very cobbly loam about 12 inches thick. The subsoil is brown extremely cobbly loam about 15 inches thick. The substratum also is brown extremely cobbly loam. It is about 8 inches thick. Weathered bedrock is at a depth of about 35 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Permeability is moderately rapid in the Farva soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

Rock outcrop consists of areas of exposed bedrock. Runoff is very rapid in these areas.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and white fir. Other species that grow on this unit include ponderosa pine and incense cedar. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and common snowberry.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 100 on the Farva soil. The yield at culmination of the mean annual increment is 5,040 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 39,750 board feet per acre (Scribner rule) at 150 years. On the basis of a 50-year curve, the mean site index is 70.

On the basis of a 50-year site curve, the mean site index for white fir is 65 on the Farva soil. The yield at culmination of the mean annual increment is 10,150 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years.

The main limitations affecting timber production are the slope, the Rock outcrop, erosion, compaction, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. The Rock outcrop can cause breakage of falling timber and can hinder yarding. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Building the roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. The large number of rock fragments in the soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced by providing artificial shade for seedlings. Reforestation can be accomplished by planting ponderosa pine and Douglas fir seedlings.

Severe frost can damage or kill seedlings. Proper timber harvesting methods can reduce the effect of frost on regeneration.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The main limitations affecting livestock grazing are erosion, compaction, the slope, and the Rock outcrop. The native vegetation suitable for grazing includes western fescue, mountain brome, tall trisetum, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

Because of the slope and the Rock outcrop, areas of this unit can hinder livestock movement.

The vegetative site is Mixed Fir-Serviceberry Forest.

61A—Foehlin gravelly loam, 0 to 3 percent slopes. This very deep, well drained soil is on stream terraces. It formed in alluvium derived dominantly from metamorphic rock. Elevation is 1,000 to 2,500 feet. The mean annual precipitation is 25 to 35 inches, the mean annual temperature is 50 to 54 degrees F, and the average frost-free period is 140 to 180 days. The vegetation in areas that have not been cultivated is mainly grasses, shrubs, and forbs.

Typically, the surface layer is very dark grayish brown gravelly loam about 4 inches thick. The next layer is very dark grayish brown clay loam about 15 inches thick. The subsoil to a depth of 60 inches is dark brown, brown, and dark yellowish brown clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is not gravelly.

Included in this unit are small areas of Evans, Newberg, and Camas soils on flood plains; Gregory soils on concave slopes and near drainageways; Ruch soils on alluvial fans; Takilma, Medford, and Central Point soils; and soils that are similar to the Foehlin soil but have strata of sand and gravel at a depth of more than 40 inches. Also included are small areas of Foehlin soils that have slopes of more than 3 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately slow in the Foehlin soil. Available water capacity is about 10 inches. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used mainly for irrigated crops, such as alfalfa hay, tree fruit, and small grain. Other crops include corn for silage and sugar beet seed. Some areas are used for homesite development, grass-legume hay, or pasture.

This unit is well suited to irrigated crops. It is limited mainly by the moderately slow permeability. In summer, irrigation is needed for the maximum production of most crops. Furrow, border, corrugation, trickle, and sprinkler irrigation systems are suitable. The system used generally is governed by the crop that is grown. For the efficient application and removal of surface irrigation water, land leveling is needed. To prevent overirrigation and excessive erosion, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. The use of pipe, ditch lining, or drop structures in irrigation ditches reduces water loss and the hazard of erosion.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Leaving crop residue on or near the surface helps to conserve moisture and control erosion.

A tillage pan forms easily if the soil is tilled when wet. Chiseling or subsoiling breaks up the pan. Surface crusting and compaction can be minimized by returning crop residue to the soil.

Solid-set sprinkler irrigation is the best method of controlling frost and providing adequate moisture for tree fruit. Compaction can be minimized by limiting the use of equipment when the soil is wet and by planting a cover crop. A permanent cover crop helps to control runoff and erosion.

Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

This unit is well suited to homesite development. The main limitation is the moderately slow permeability. If the soil is used as a site for septic tank absorption fields, the moderately slow permeability can be overcome by increasing the size of the absorption field.

Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

The vegetative site is Deep Loamy Terrace, 18- to 28-inch precipitation zone.

62C—Freezener gravelly loam, 1 to 12 percent slopes. This very deep, well drained soil is on plateaus. It formed in residuum and colluvium derived from andesite. Elevation is 1,500 to 4,000 feet. The mean annual precipitation is 30 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about 1½ inches thick. The surface layer is dark reddish brown gravelly loam about 9 inches thick. The upper 9 inches of the subsoil is dark reddish brown clay loam. The lower 42 inches is dark reddish brown and dark brown clay and clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is cobbly or stony.

Included in this unit are small areas of Terrabella soils near drainageways and on concave slopes, Geppert soils on the more sloping parts of the landscape and on convex slopes, and soils that are similar to the Freezener soil but have more than 35 percent rock fragments or have bedrock within a depth of 60 inches. Also included are small areas of Freezener soils that have slopes of more than 12 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderately slow in the Freezener soil. Available water capacity is about 9 inches. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir. Other species that grow on this unit include sugar pine, ponderosa pine, white fir, and California black oak. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 140. The yield at culmination of the mean annual increment is 8,700 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 69,410 board feet per acre (Scribner rule) at 110 years. On the basis of a 50-year curve, the mean site index is 105.

The main limitations affecting timber production are compaction, erosion, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Conventional methods of harvesting timber generally are suitable, but the soil may be compacted if it is moist when heavy equipment is used. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Erosion can be controlled by carefully planning the construction and maintenance of logging roads, skid trails, and landings. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

Severe frost can damage or kill seedlings. Air drainage may be restricted on this unit. Proper timber harvesting methods can reduce the effect of frost on regeneration.

The main limitation affecting livestock grazing is compaction. The native vegetation suitable for grazing includes western fescue, mountain brome, tall trisetum, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Mixed Pine Forest.

63E—Freezener gravelly loam, 12 to 35 percent north slopes. This very deep, well drained soil is on hillslopes. It formed in colluvium derived from andesite. Elevation is 1,500 to 4,000 feet. The mean annual precipitation is 30 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about 1½ inches thick. The surface layer is dark reddish brown gravelly loam about 9 inches thick. The upper 9 inches of the subsoil is dark reddish brown clay loam. The lower 42 inches is dark reddish brown and dark brown clay and clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is cobbly or stony.

Included in this unit are small areas of Terrabella soils near drainageways and on concave slopes, Geppert soils on the more sloping parts of the landscape and on convex slopes, and soils that are similar to the Freezener soil but have more than 35 percent rock fragments or have bedrock within a depth of 60 inches. Also included are small areas of Freezener soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderately slow in the Freezener soil. Available water capacity is about 9 inches. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir. Other species that grow on this unit include white fir, incense cedar, and Pacific dogwood. The understory vegetation includes Pacific serviceberry, cascade Oregongrape, and deerfoot vanillaleaf.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 140. The yield at culmination of the mean annual increment is 8,700 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 69,410 board feet per acre (Scribner rule) at 110 years. On the basis of a 50-year curve, the mean site index is 105.

The main limitations affecting timber production are erosion, compaction, and plant competition. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The main limitations affecting livestock grazing are compaction and erosion. The native vegetation suitable for grazing includes western fescue, mountain brome, tall trisetum, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Dogwood Forest.

64E—Freezener gravelly loam, 12 to 35 percent south slopes. This very deep, well drained soil is on hillslopes. It formed in colluvium derived from andesite. Elevation is 1,500 to 4,000 feet. The mean annual precipitation is 30 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about 1½ inches thick. The surface layer is dark reddish brown gravelly loam about

9 inches thick. The upper 9 inches of the subsoil is dark reddish brown clay loam. The lower 42 inches is dark reddish brown and dark brown clay and clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is cobbly or stony.

Included in this unit are small areas of Terrabella soils near drainageways and on concave slopes, Geppert soils on the more sloping parts of the landscape and on convex slopes, and soils that are similar to the Freezener soil but have more than 35 percent rock fragments or have bedrock within a depth of 60 inches. Also included are small areas of Freezener soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderately slow in the Freezener soil. Available water capacity is about 9 inches. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir. Other species that grow on this unit include sugar pine, ponderosa pine, white fir, and California black oak. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 125. The yield at culmination of the mean annual increment is 7,320 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 58,200 board feet per acre (Scribner rule) at 120 years. On the basis of a 50-year curve, the mean site index is 90.

The main limitations affecting timber production are erosion, compaction, seedling mortality, and plant competition. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The main limitations affecting livestock grazing are compaction and erosion. The native vegetation suitable for grazing includes western fescue, mountain brome, tall trisetum, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the soil is firm and the more desirable forage plants have achieved enough growth to withstand grazing pressure.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Mixed Pine Forest.

65C—Freezener-Geppert complex, 1 to 12 percent slopes. This map unit is on plateaus. Elevation is 1,500 to 4,000 feet. The mean annual precipitation is 30 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 65 percent Freezener soil and 30 percent Geppert soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Terrabella soils near drainageways and on concave slopes and soils that are similar to the Freezener soil but have more than 35 percent rock fragments or have bedrock within a depth of 60 inches. Also included are small areas of Freezener and Geppert soils that have slopes of more than 12 percent. Included areas make up about 5 percent of the total acreage.

The Freezener soil is very deep and well drained. It formed in residuum and colluvium derived dominantly from andesite. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1½ inches thick. The surface layer is dark reddish brown gravelly loam about 9 inches thick. The upper 9 inches of the subsoil is dark reddish brown clay loam. The lower 42 inches is dark reddish brown and dark brown clay and clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is cobbly or stony.

Permeability is moderately slow in the Freezener soil. Available water capacity is about 9 inches. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

The Geppert soil is moderately deep and well drained. It formed in colluvium derived dominantly from andesite. Typically, the surface is covered with a layer of needles, leaves, and twigs about ½ inch thick. The surface layer is dark reddish brown very cobbly loam about 13 inches thick. The subsoil is dark reddish brown extremely cobbly clay loam about 17 inches thick. Weathered bedrock is at a depth of about 30 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Permeability is moderate in the Geppert soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir. Other species that grow on this unit include sugar pine, ponderosa pine, white fir, and California black oak. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 140 on the Freezener soil. The yield at culmination of the mean annual increment is 8,700 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 69,410 board feet per acre (Scribner rule) at 110 years. On the basis of a 50-year curve, the mean site index is 105.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 100 on the Geppert soil. The yield at culmination of the mean annual increment is 5,040 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 39,750 board feet per acre (Scribner rule) at 150 years. On the basis of a 50-year curve, the mean site index is 75.

The main limitations affecting timber production are compaction, erosion, plant competition, and seedling mortality. Also, the bedrock underlying the Geppert soil restricts root growth. As a result, windthrow is a hazard.

Conventional methods of harvesting timber generally are suitable, but the soils may be compacted if they are moist when heavy equipment is used. Puddling can occur when the soils are wet. If the soils are excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Erosion can be controlled by carefully planning the construction and maintenance of logging roads, skid trails, and landings. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. The large number of rock fragments in the Geppert soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings.

Severe frost can damage or kill seedlings. Air drainage may be restricted on this unit. Proper timber harvesting methods can reduce the effect of frost on regeneration.

The main limitation affecting livestock grazing is compaction. The native vegetation suitable for grazing includes western fescue, mountain brome, tall trisetum, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soils. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Mixed Pine Forest.

66E—Freezener-Geppert complex, 12 to 35 percent north slopes. This map unit is on hillslopes. Elevation is 1,500 to 4,000 feet. The mean annual precipitation is 30 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 65 percent Freezener soil and 30 percent Geppert soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Terrabella soils near drainageways and on concave slopes and soils that are similar to the Freezener soil but have more than 35 percent rock fragments or have bedrock within a depth of 60 inches. Also included are small areas of Freezener and Geppert soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 5 percent of the total acreage.

The Freezener soil is very deep and well drained. It formed in colluvium derived dominantly from andesite. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1½ inches thick. The surface layer is dark reddish brown gravelly loam about 9 inches thick. The upper 9 inches of the subsoil is dark reddish brown clay loam. The lower 42 inches is dark reddish brown and dark brown clay and clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is cobbly or stony.

Permeability is moderately slow in the Freezener soil. Available water capacity is about 9 inches. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

The Geppert soil is moderately deep and well drained. It formed in colluvium derived dominantly from andesite. Typically, the surface is covered with a layer of needles, leaves, and twigs about ½ inch thick. The surface layer is dark reddish brown very cobbly loam about 13 inches thick. The subsoil is dark reddish brown extremely cobbly clay loam about 17 inches thick. Weathered bedrock is at a depth of about 30 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Permeability is moderate in the Geppert soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir. Other species that grow on this unit include white fir, incense cedar, and Pacific dogwood. The understory vegetation includes Pacific serviceberry, cascade Oregongrape, and deerfoot vanillaleaf.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 140 on the Freezener soil. The yield at culmination of the mean annual increment is 8,700 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 69,410 board feet per acre (Scribner rule) at 110 years. On the basis of a 50-year curve, the mean site index is 105.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 120 on the Geppert soil. The yield at culmination of the mean annual increment is 6,900 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 52,440 board feet per acre (Scribner rule) at 120 years. On the basis of a 50-year curve, the mean site index is 80.

The main limitations affecting timber production are erosion, compaction, plant competition, and seedling mortality. Also, the bedrock underlying the Geppert soil restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. If the soils are excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soils are moist causes rutting and compaction. Puddling can occur when the soils are wet. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. The large number of rock fragments in the Geppert soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings.

The main limitations affecting livestock grazing are compaction and erosion. The native vegetation suitable for grazing includes western fescue, mountain brome, tall trisetum, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soils. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Dogwood Forest.

66G—Freezener-Geppert complex, 35 to 60 percent north slopes. This map unit is on hillslopes. Elevation is 1,500 to 4,000 feet. The mean annual precipitation is 30 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 65 percent Freezener soil and 30 percent Geppert soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of McMullin soils and Rock outcrop on ridges and convex slopes and soils that are similar to the Freezener soil but have more than 35 percent rock fragments or have bedrock within a depth of 60 inches. Also included are small areas of Freezener and Geppert soils that have slopes of less than 35 or more than 60 percent. Included areas make up about 5 percent of the total acreage.

The Freezener soil is very deep and well drained. It formed in colluvium derived dominantly from andesite. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1½ inches thick. The surface layer is dark reddish brown gravelly loam about 9 inches thick. The upper 9 inches of the subsoil is dark reddish brown clay loam. The lower 42 inches is dark reddish brown and dark brown clay and clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is cobbly or stony.

Permeability is moderately slow in the Freezener soil. Available water capacity is about 9 inches. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

The Geppert soil is moderately deep and well drained. It formed in colluvium derived dominantly from andesite. Typically, the surface is covered with a layer of needles, leaves, and twigs about ½ inch thick. The surface layer is dark reddish brown very cobbly loam about 13 inches thick. The subsoil is dark reddish brown extremely cobbly clay loam about 17 inches thick. Weathered bedrock is at a depth of about 30 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Permeability is moderate in the Geppert soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir. Other species that grow on this unit include white fir, incense cedar, and Pacific dogwood. The understory vegetation includes Pacific serviceberry, cascade

Oregongrape, and deerfoot vanillaleaf.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 140 on the Freezener soil. The yield at culmination of the mean annual increment is 8,700 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 69,410 board feet per acre (Scribner rule) at 110 years. On the basis of a 50-year curve, the mean site index is 105.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 120 on the Geppert soil. The yield at culmination of the mean annual increment is 6,900 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 52,440 board feet per acre (Scribner rule) at 120 years. On the basis of a 50-year curve, the mean site index is 80.

The main limitations affecting timber production are the slope, erosion, compaction, plant competition, and seedling mortality. Also, the bedrock underlying the Geppert soil restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. If the soils are excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soils are moist causes rutting and compaction. Puddling can occur when the soils are wet. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soils are saturated.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Building the roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. The large number of rock fragments in the Geppert soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings.

The main limitations affecting livestock grazing are erosion, compaction, and the slope. The native vegetation suitable for grazing includes western fescue, mountain brome, tall trisetum, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soils. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Dogwood Forest.

67E—Freezener-Geppert complex, 12 to 35 percent south slopes. This map unit is on hillslopes. Elevation is 1,500 to 4,000 feet. The mean annual precipitation is 30 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 65 percent Freezener soil and 30 percent Geppert soil. The components of this unit occur as areas so intricately intermingled that mapping them

separately was not practical at the scale used.

Included in this unit are small areas of Terrabella soils near drainageways and on concave slopes and soils that are similar to the Freezener soil but have more than 35 percent rock fragments or have bedrock within a depth of 60 inches. Also included are small areas of Freezener and Geppert soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 5 percent of the total acreage.

The Freezener soil is very deep and well drained. It formed in colluvium derived dominantly from andesite. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1½ inches thick. The surface layer is dark reddish brown gravelly loam about 9 inches thick. The upper 9 inches of the subsoil is dark reddish brown clay loam. The lower 42 inches is dark reddish brown and dark brown clay and clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is cobbly or stony.

Permeability is moderately slow in the Freezener soil. Available water capacity is about 9 inches. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

The Geppert soil is moderately deep and well drained. It formed in colluvium derived dominantly from andesite. Typically, the surface is covered with a layer of needles, leaves, and twigs about ½ inch thick. The surface layer is dark reddish brown very cobbly loam about 13 inches thick. The subsoil is dark reddish brown extremely cobbly clay loam about 17 inches thick. Weathered bedrock is at a depth of about 30 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Permeability is moderate in the Geppert soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include sugar pine, white fir, and California black oak. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 125 on the Freezener soil. The yield at culmination of the mean annual increment is 7,320 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 58,200 board feet per acre (Scribner rule) at 120 years. On the basis of a 50-year curve, the mean site index is 90.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 95 on the Geppert soil. The yield at culmination of the mean annual increment is 4,620 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 37,120 board feet per acre (Scribner rule) at 160 years. On the basis of a 50-year curve, the mean site index is 70.

The main limitations affecting timber production are erosion, compaction, seedling mortality, and plant competition. Also, the bedrock underlying the Geppert soil restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. If the soils are excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soils are moist causes rutting and compaction. Puddling can occur when the soils are wet. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. The large number of rock fragments in the Geppert soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The main limitations affecting livestock grazing are compaction and erosion. The native vegetation suitable for grazing includes western fescue, mountain brome, tall trisetum, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soils. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Mixed Pine Forest.

67G—Freezener-Geppert complex, 35 to 60 percent south slopes. This map unit is on hillslopes. Elevation is 1,500 to 4,000 feet. The mean annual precipitation is 30 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 65 percent Freezener soil and 30 percent Geppert soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of McMullin soils and Rock outcrop on ridges and convex slopes and soils that are similar to the Freezener soil but have more than 35 percent rock fragments or have bedrock within a depth of 60 inches. Also included are small areas of Freezener and Geppert soils that have slopes of less than 35 or more than 60 percent. Included areas make up about 5 percent of the total acreage.

The Freezener soil is very deep and well drained. It formed in colluvium derived dominantly from andesite. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1½ inches thick. The surface layer is dark reddish brown gravelly loam about 9 inches thick. The upper 9 inches of the subsoil is dark reddish brown clay loam. The lower 42 inches is dark reddish brown and dark brown clay and clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is cobbly or stony.

Permeability is moderately slow in the Freezener soil. Available water capacity is about 9 inches. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

The Geppert soil is moderately deep and well drained. It formed in colluvium derived dominantly from andesite. Typically, the surface is covered with a layer of needles, leaves, and twigs about ½ inch thick. The surface layer is dark reddish brown very cobbly loam about 13 inches thick. The subsoil is dark reddish brown extremely cobbly clay loam about 17 inches thick. Weathered bedrock is at a depth of about 30 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Permeability is moderate in the Geppert soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include sugar pine, white fir, and California black oak. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 125 on the Freezener soil. The yield at culmination of the mean annual increment is 7,320 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 58,200 board feet per acre (Scribner rule) at 120 years. On the basis of a 50-year curve, the mean site index is 90.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 95 on the Geppert soil. The yield at culmination of the mean annual increment is 4,620 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 37,120 board feet per acre (Scribner rule) at 160 years. On the basis of a 50-year curve, the mean site index is 70.

The main limitations affecting timber production are the slope, erosion, compaction, seedling mortality, and plant competition. Also, the bedrock underlying the Geppert soil restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. If the soils are excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soils are moist causes rutting and compaction. Puddling can occur when the soils are wet. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soils are saturated.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Building the roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. The large number of rock fragments in the Geppert soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced by providing artificial shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The main limitations affecting livestock grazing are erosion, compaction, and the slope. The native vegetation suitable for grazing includes western fescue, mountain brome, tall trisetum, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soils. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Mixed Pine Forest.

68C—Geppert very cobbly loam, 1 to 12 percent slopes. This moderately deep, well drained soil is on plateaus. It formed in colluvium derived from andesite. Elevation is 1,500 to 4,000 feet. The mean annual precipitation is 30 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about ½ inch thick. The surface layer is dark reddish brown very cobbly loam about 13 inches thick. The subsoil is dark reddish brown extremely cobbly clay loam about 17 inches thick. Weathered bedrock is at a depth of about 30 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Included in this unit are small areas of Terrabella soils near drainageways and on concave slopes, Freezener soils on concave slopes, Rock outcrop on convex slopes, and soils that are similar to the Geppert soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Geppert soils that have slopes of more than 12 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Geppert soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir. Other species that grow on this unit include sugar pine, ponderosa pine, white fir, and California black oak. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 100. The yield at culmination of the mean annual increment is 5,040 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 39,750 board feet per acre (Scribner rule) at 150 years. On the basis of a 50-year curve, the mean site index is 75.

The main limitations affecting timber production are compaction, erosion, plant competition, and seedling mortality. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Conventional methods of harvesting timber generally are suitable, but the soil may be compacted if it is moist when heavy equipment is used. Puddling can occur when the soil is wet. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Erosion can be controlled by carefully planning the construction and maintenance of logging roads, skid trails, and landings. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. The large number of rock fragments in the soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings.

Severe frost can damage or kill seedlings. Air drainage may be restricted on this unit. Proper timber harvesting methods can reduce the effect of frost on regeneration.

The main limitation affecting livestock grazing is compaction. The native vegetation suitable for grazing includes western fescue, mountain brome, tall trisetum, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Mixed Pine Forest.

69E—Geppert very cobbly loam, 12 to 35 percent north slopes. This moderately deep, well drained soil is on hillslopes. It formed in colluvium derived from andesite. Elevation is 1,500 to 4,000 feet. The mean annual precipitation is 30 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about ½ inch thick. The surface layer is dark reddish brown very cobbly loam about 13 inches thick. The subsoil is dark reddish brown extremely cobbly clay loam about 17 inches thick. Weathered bedrock is at a depth of about 30 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Included in this unit are small areas of Terrabella soils near drainageways and on concave slopes, Freezener soils on concave slopes, Rock outcrop on ridges and convex slopes, and soils that are similar to the Geppert soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Geppert soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Geppert soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir. Other species that grow on this unit include white fir, incense cedar, and Pacific dogwood. The understory vegetation includes Pacific serviceberry, cascade

Oregongrape, and deerfoot vanillaleaf.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 120. The yield at culmination of the mean annual increment is 6,900 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 52,440 board feet per acre (Scribner rule) at 120 years. On the basis of a 50-year curve, the mean site index is 80.

The main limitations affecting timber production are erosion, compaction, plant competition, and seedling mortality. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. The large number of rock fragments in the soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings.

The main limitations affecting livestock grazing are compaction and erosion. The native vegetation suitable for grazing includes western fescue, mountain brome, tall trisetum, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Dogwood Forest.

69G—Geppert very cobbly loam, 35 to 70 percent north slopes. This moderately deep, well drained soil is on hillslopes. It formed in colluvium derived from andesite. Elevation is 1,500 to 4,000 feet. The mean annual precipitation is 30 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about ½ inch thick. The surface layer is dark reddish brown very cobbly loam about 13 inches thick. The subsoil is dark reddish brown extremely cobbly clay loam about 17 inches thick. Weathered bedrock is at a depth of about 30 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Included in this unit are small areas of Freezener soils on the less sloping parts of the landscape, Rock outcrop on ridges and convex slopes, and soils that are similar to the Geppert soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Geppert soils that have slopes of less than 35 or more than 70 percent. Included areas make up about 10 percent of the total acreage.

Permeability is moderate in the Geppert soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir. Other species that grow on this unit include white fir, incense cedar, and Pacific dogwood. The understory vegetation includes Pacific serviceberry, cascade Oregongrape, and deerfoot vanillaleaf.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 120. The yield at culmination of the mean annual increment is 6,900 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 52,440 board feet per acre (Scribner rule) at 120 years. On the basis of a 50-year curve, the mean site index is 80.

The main limitations affecting timber production are the slope, erosion, compaction, plant competition, and seedling mortality. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Building the roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. The large number of rock fragments in the soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings.

The main limitations affecting livestock grazing are erosion, compaction, and the slope. The native vegetation suitable for grazing includes western fescue, mountain brome, tall trisetum, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Dogwood Forest.

70E—Geppert very cobbly loam, 12 to 35 percent south slopes. This moderately deep, well drained soil is on hillslopes. It formed in colluvium derived from andesite. Elevation is 1,500 to 4,000 feet. The mean annual precipitation is 30 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about ½ inch thick. The surface layer is dark reddish brown very cobbly loam about 13 inches thick. The subsoil is dark reddish brown extremely cobbly clay loam about 17 inches thick. Weathered bedrock is at a depth of about 30 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Included in this unit are small areas of Terrabella soils near drainageways and on concave slopes, Freezener soils on concave slopes, Rock outcrop on ridges and convex slopes, and soils that are similar to the Geppert soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Geppert soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Geppert soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include sugar pine, white fir, and California black oak. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 95. The yield at culmination of the mean annual increment is 4,620 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 37,120 board feet per acre (Scribner rule) at 160 years. On the basis of a 50-year curve, the mean site index is 70.

The main limitations affecting timber production are erosion, compaction, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. The large number of rock fragments in the soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The main limitations affecting livestock grazing are compaction and erosion. The native vegetation suitable for grazing includes western fescue, mountain brome, tall trisetum, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Mixed Pine Forest.

70G—Geppert very cobbly loam, 35 to 60 percent south slopes. This moderately deep, well drained soil is on hillslopes. It formed in colluvium derived from andesite. Elevation is 1,500 to 4,000 feet. The mean annual precipitation is 30 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about ½ inch thick. The surface layer is dark reddish brown very cobbly loam about 13 inches thick. The subsoil is dark reddish brown extremely cobbly clay loam about 17 inches thick. Weathered bedrock is at a depth of about 30 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Included in this unit are small areas of Freezener soils on the less sloping parts of the landscape, Rock outcrop on ridges and convex slopes, and soils that are similar to the Geppert soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Geppert soils that have slopes of less than 35 or more than 60 percent. Included areas make up about 10 percent of the total acreage.

Permeability is moderate in the Geppert soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include sugar pine, white fir, and California black oak. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 95. The yield at culmination of the mean annual increment is 4,620 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 37,120 board feet per acre (Scribner rule) at 160 years. On the basis of a 50-year curve, the mean site index is 70.

The main limitations affecting timber production are the slope, erosion, compaction, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Building the roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. The large number of rock fragments in the soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced by providing artificial shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The main limitations affecting livestock grazing are erosion, compaction, and the slope. The native vegetation suitable for grazing includes western fescue, mountain brome, tall trisetum, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Mixed Pine Forest.

71E—Goolaway silt loam, 20 to 35 percent north slopes. This moderately deep, well drained soil is on hillslopes. It formed in colluvium derived dominantly from schist. Elevation is 1,500 to 4,000 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about 2 inches thick. The surface layer is very dark grayish brown silt loam about 3 inches thick. The next layer is dark grayish brown silt loam about 8 inches thick. The subsoil is olive gray and olive silt loam about 18 inches thick. Weathered bedrock is at a depth of about 29 inches. The depth to bedrock ranges from 20 to 40 inches.

Included in this unit are small areas of Josephine, Siskiyou, and Speaker soils; Musty soils on ridges and convex slopes; Pollard soils on the less sloping parts of the landscape and on concave slopes; poorly drained soils near drainageways and on concave slopes; and soils that are similar to the Goolaway soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Goolaway soils that have slopes of less than 20 or more than 35 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderate in the Goolaway soil. Available water capacity is about 6 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate or high.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir. Other species that grow on this unit include ponderosa pine, incense cedar, and sugar pine. The understory vegetation includes golden chinkapin, cascade Oregongrape, and deerfoot vanillaleaf.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 125. The yield at culmination of the mean annual increment is 7,320 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 58,200 board feet per acre (Scribner rule) at 120 years. On the basis of a 50-year curve, the mean site index is 95.

The main limitations affecting timber production are erosion, compaction, slumping, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

When timber is harvested, management that minimizes the risk of erosion is essential. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both.

This unit is subject to slumping. Road failure and landslides are likely to occur after road construction and clearcutting. Slumping can be minimized by constructing logging roads in the less sloping areas, on better suited soils if practical, and by installing properly designed road drainage systems. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

Increased erosion, loss of plant nutrients, and water repellency are likely to result from fires of moderate intensity.

The vegetative site is Douglas Fir-Chinkapin Forest.

71F—Goolaway silt loam, 35 to 50 percent north slopes. This moderately deep, well drained soil is on hillslopes. It formed in colluvium derived dominantly from schist. Elevation is 1,500 to 4,000 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about 2 inches thick. The surface layer is very dark grayish brown silt loam about 3 inches thick. The next layer is dark grayish brown silt loam about 8 inches thick. The subsoil is olive gray and olive silt loam about 18 inches thick. Weathered bedrock is at a depth of about 29 inches. The depth to bedrock ranges from 20 to 40 inches.

Included in this unit are small areas of Josephine, Siskiyou, and Speaker soils; Musty soils on ridges and convex slopes; Pollard soils on the less sloping parts of the landscape and on concave slopes; and soils that are similar to the Goolaway soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Goolaway soils that have slopes of less than 35 or more than 50 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderate in the Goolaway soil. Available water capacity is about 6 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir. Other species that grow on this unit include ponderosa pine, incense cedar, and sugar pine. The understory vegetation includes golden chinkapin, cascade Oregongrape, and deerfoot vanillaleaf.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 125. The yield at culmination of the mean annual increment is 7,320 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 58,200 board feet per acre (Scribner rule) at 120 years. On the basis of a 50-year curve, the mean site index is 95.

The main limitations affecting timber production are the slope, erosion, compaction, slumping, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

When timber is harvested, management that minimizes the risk of erosion is essential. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation.

This unit is subject to slumping. Road failure and landslides are likely to occur after road construction and clearcutting. Slumping can be minimized by constructing logging roads in the less sloping areas, on better suited soils if practical, and by installing properly designed road drainage systems. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

Increased erosion, loss of plant nutrients, and water repellency are likely to result from fires of moderate intensity.

The vegetative site is Douglas Fir-Chinkapin Forest.

72E—Goolaway silt loam, 20 to 35 percent south slopes. This moderately deep, well drained soil is on hillslopes. It formed in colluvium derived dominantly from schist. Elevation is 1,500 to 4,000 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about 2 inches thick. The surface layer is very dark grayish brown silt loam about 3 inches thick. The next layer is dark grayish brown silt loam about 8 inches thick. The subsoil is olive gray and olive silt loam about 18 inches thick. Weathered bedrock is at a depth of about 29 inches. The depth to bedrock ranges from 20 to 40 inches.

Included in this unit are small areas of Josephine, Siskiyou, and Speaker soils; Musty soils on ridges and convex slopes; Pollard soils on the less sloping parts of the landscape and on concave slopes; poorly drained soils near drainageways and on concave slopes; and soils that are similar to the Goolaway soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Goolaway soils that have slopes of less than 20 or more than 35 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderate in the Goolaway soil. Available water capacity is about 6 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate or high.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir. Other species that grow on this unit include ponderosa pine, sugar pine, and California black oak. The understory vegetation includes canyon live oak, deerbrush, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 115. The yield at culmination of the mean annual increment is 6,360 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 50,700 board feet per acre (Scribner rule) at 130 years. On the basis of a 50-year curve, the mean site index is 90.

The main limitations affecting timber production are erosion, compaction, slumping, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

When timber is harvested, management that minimizes the risk of erosion is essential. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both.

This unit is subject to slumping. Road failure and landslides are likely to occur after road construction and clearcutting. Slumping can be minimized by constructing logging roads in the less sloping areas, on better suited soils if practical, and by installing properly designed road drainage systems. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

Increased erosion, loss of plant nutrients, and water repellency are likely to result from fires of moderate intensity.

The vegetative site is Douglas Fir-Black Oak Forest.

72F—Goolaway silt loam, 35 to 50 percent south slopes. This moderately deep, well drained soil is on hillslopes. It formed in colluvium derived dominantly from schist. Elevation is 1,500 to 4,000 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about 2 inches thick. The surface layer is very dark grayish brown silt loam about 3 inches thick. The next layer is dark grayish brown silt loam about 8 inches thick. The subsoil is olive gray and olive silt loam about 18 inches thick. Weathered bedrock is at a depth of about 29 inches. The depth to bedrock ranges from 20 to 40 inches.

Included in this unit are small areas of Josephine, Siskiyou, and Speaker soils; Musty soils on ridges and convex slopes; Pollard soils on the less sloping parts of the landscape and on concave slopes; and soils that are similar to the Goolaway soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Goolaway soils that have slopes of less than 35 or more than 50 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderate in the Goolaway soil. Available water capacity is about 6 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir. Other species that grow on this unit include ponderosa pine, sugar pine, and California black oak. The understory vegetation includes canyon live oak, deerbrush, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 115. The yield at culmination of the mean annual increment is 6,360 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 50,700 board feet per acre (Scribner rule) at 130 years. On the basis of a 50-year curve, the mean site index is 90.

The main limitations affecting timber production are the slope, erosion, compaction, slumping, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

When timber is harvested, management that minimizes the risk of erosion is essential. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation.

This unit is subject to slumping. Road failure and landslides are likely to occur after road construction and clearcutting. Slumping can be minimized by constructing logging roads in the less sloping areas, on better suited soils if practical, and by installing properly designed road drainage systems. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced by providing artificial shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

Increased erosion, loss of plant nutrients, and water repellency are likely to result from fires of moderate intensity.

The vegetative site is Douglas Fir-Black Oak Forest.

73E—Goolaway-Pollard complex, 7 to 30 percent slopes. This map unit is on hillslopes and alluvial fans. Elevation is 1,500 to 4,000 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 55 percent Goolaway soil and 25 percent Pollard soil. The Goolaway soil has slopes of more than 12 percent. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Josephine, Speaker, and Wolfpeak soils; poorly drained soils near drainageways and on concave slopes; soils that are similar to the Goolaway soil but have bedrock at a depth of more than 40 inches; and Goolaway soils that have slopes of more than 30 percent. Also included are small areas of Pollard soils that have slopes of less than 7 percent. Included areas make up about 20 percent of the total acreage.

The Goolaway soil is moderately deep and well drained. It formed in colluvium derived dominantly from schist. Typically, the surface is covered with a layer of needles, leaves, and twigs about 2 inches thick. The surface layer is very dark grayish brown silt loam about 3 inches thick. The next layer is dark grayish brown silt loam about 8 inches thick. The subsoil is olive gray and olive silt loam about 18 inches thick. Weathered bedrock is at a depth of about 29 inches. The depth to bedrock ranges from 20 to 40 inches.

Permeability is moderate in the Goolaway soil. Available water capacity is about 6 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate or high.

The Pollard soil is very deep and well drained. It formed in alluvium and colluvium derived dominantly from metamorphic rock. Typically, the surface is covered with a layer of needles, leaves, and twigs about 2 inches thick. The surface layer is dark brown loam about 11 inches thick. The upper 25 inches of the subsoil is dark reddish brown clay loam. The lower 25 inches is yellowish red and brown clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is clay loam or gravelly loam.

Permeability is slow in the Pollard soil. Available water capacity is about 7 inches. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir. Other species that grow on this unit include ponderosa pine, incense cedar and sugar pine. The understory vegetation includes golden chinkapin, cascade Oregongrape, and deerfoot vanillaleaf.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 125 on the Goolaway soil. The yield at culmination of the mean annual increment is 7,320 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 58,200 board feet per acre (Scribner rule) at 120 years. On the basis of a 50-year curve, the mean site index is 95.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 130 on the Pollard soil. The yield at culmination of the mean annual increment is 7,740 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 58,520 board feet per acre (Scribner rule) at 110 years. On the basis of a 50-year curve, the mean site index is 95.

The main limitations affecting timber production are erosion, compaction, slumping, plant competition, and seedling mortality. Also, the bedrock underlying the Goolaway soil restricts root growth. As a result, windthrow is a hazard.

When timber is harvested, management that minimizes the risk of erosion is essential. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. Using standard wheeled and tracked equipment when the soils are moist causes rutting and compaction. Puddling can occur when the soils are wet. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

This unit is subject to slumping. Road failure and landslides are likely to occur after road construction and clearcutting. Slumping can be minimized by constructing logging roads in the less sloping areas, on better suited soils if practical, and by installing properly designed road drainage systems.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate, especially on south- and southwest-facing slopes. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings.

Increased erosion, loss of plant nutrients, and water repellency are likely to result from fires of moderate intensity.

The vegetative site is Douglas Fir-Chinkapin Forest.

74F—Gravecreek gravelly loam, 35 to 55 percent north slopes. This moderately deep, well drained soil is on hillslopes. It formed in colluvium derived from serpentinitic rock. Elevation is 2,200 to 4,300 feet. The mean annual precipitation is 45 to 55 inches, the mean annual temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is very dark grayish brown and dark brown gravelly loam about 7 inches thick. The upper 8 inches of the subsoil is brown very gravelly clay loam. The lower 14 inches is light olive brown very cobbly clay loam. Bedrock is at a depth of about 29 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is very cobbly or stony.

Included in this unit are small areas of Acker, Dubakella, and Norling soils; Rock outcrop and Pearsoll soils on ridges and convex slopes; Dumont soils on concave slopes and on the less sloping parts of the landscape; and, on concave slopes and foot slopes, soils that are similar to the Gravecreek soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Gravecreek soils that have slopes of less than 35 or more than 55 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately slow in the Gravecreek soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir. Other species that grow on this unit include incense cedar, Jeffrey pine, sugar pine, and Pacific madrone. The understory vegetation includes cascade Oregongrape, common beargrass, and creambush oceanspray.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 95. The yield at culmination of the mean annual increment is 4,620 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 37,120 board feet per acre (Scribner rule) at 160 years. On the basis of a 50-year curve, the mean site index is 70.

The main limitations affecting timber production are the slope, erosion, compaction, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high content of magnesium and low content of calcium increase the seedling mortality rate. The large number of rock fragments in the soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. Reforestation can be accomplished by planting Jeffrey pine, ponderosa pine, and Douglas fir seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The vegetative site is Douglas Fir-Beargrass Forest, Serpentine.

74G—Gravecreek gravelly loam, 55 to 80 percent north slopes. This moderately deep, well drained soil is on hillslopes. It formed in colluvium derived from serpentinitic rock. Elevation is 2,200 to 4,300 feet. The mean annual precipitation is 45 to 55 inches, the mean annual temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is very dark grayish brown and dark brown gravelly loam about 7 inches thick. The upper 8 inches of the subsoil is brown very gravelly clay loam. The lower 14 inches is light olive brown very cobbly clay loam. Bedrock is at a depth of about 29 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is very cobbly or stony.

Included in this unit are small areas of Acker, Dubakella, and Norling soils; Rock outcrop and Pearsoll soils on ridges and convex slopes; and soils that are similar to the Gravecreek soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Gravecreek soils that have slopes of less than 55 or more than 80 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately slow in the Gravecreek soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir. Other species that grow on this unit include incense cedar, Jeffrey pine, sugar pine, and Pacific madrone. The understory vegetation includes cascade Oregongrape, common beargrass, and creambush oceanspray.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 95. The yield at culmination of the mean annual increment is 4,620 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 37,120 board feet per acre (Scribner rule) at 160 years. On the basis of a 50-year curve, the mean site index is 70.

The main limitations affecting timber production are the slope, erosion, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

The slope restricts the use of wheeled and tracked logging equipment. High-lead or other cable systems are the best methods of logging. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Ripping landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Road cuts on this unit expose a large amount of fractured bedrock, which limits the response to seeding and mulching. Cut slopes are subject to slumping where the bedrock is highly fractured or where rock layers are parallel to the slopes (fig. 8). Steep yarding paths and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both.

Building logging roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high content of magnesium and low content of calcium increase the seedling mortality rate. The large number of rock fragments in the soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. Reforestation can be accomplished by planting Jeffrey pine, ponderosa pine, and Douglas fir seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The vegetative site is Douglas Fir-Beargrass Forest, Serpentine.

75E—Gravecreek cobbly loam, 12 to 35 percent south slopes. This moderately deep, well drained soil is on hillslopes and ridges. It formed in colluvium derived from serpentinitic rock. Elevation is 2,200 to 4,300 feet. The mean annual precipitation is 45 to 55 inches, the mean annual temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is very dark grayish brown cobbly loam about 3 inches thick. The next layer is dark brown gravelly loam about 4 inches thick. The upper 8 inches of the subsoil is brown very gravelly clay loam. The lower 14 inches is light olive brown very cobbly clay loam. Bedrock is at a depth of about 29 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is very cobbly or stony.

Figure 8.—Cut slope slumping onto a road in an area of Gravecreek gravelly loam, 55 to 80 percent north slopes.

Included in this unit are small areas of Acker, Dubakella, Dumont, and Norling soils; Rock outcrop and Pearsoll soils on ridges and convex slopes; poorly drained soils on concave slopes and near drainageways; and, on concave slopes and foot slopes, soils that are similar to the Gravecreek soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Gravecreek soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately slow in the Gravecreek soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir. Other species that grow on this unit include incense cedar, Jeffrey pine, and Pacific madrone. The understory vegetation includes canyon live oak, common beargrass, and California fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 90. The yield at culmination of the mean annual increment is 4,200 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 31,840 board feet per acre (Scribner rule) at 160 years. On the basis of a 50-year curve, the mean site index is 65.

The main limitations affecting timber production are erosion, compaction, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. In some areas stones on the surface can cause breakage of falling timber and can hinder yarding. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer during summer, the low available water capacity, and a nutrient imbalance caused by the serpentinitic rock increase the seedling mortality rate. The large number of rock fragments in the soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. Reforestation can be accomplished by planting Jeffrey pine, ponderosa pine, and Douglas fir seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The vegetative site is Douglas Fir-Beargrass Forest, Serpentine.

75F—Gravecreek cobbly loam, 35 to 55 percent south slopes. This moderately deep, well drained soil is on hillslopes. It formed in colluvium derived from serpentinitic rock. Elevation is 2,200 to 4,300 feet. The mean annual precipitation is 45 to 55 inches, the mean annual temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is very dark grayish brown cobbly loam about 3 inches thick. The next layer is dark brown gravelly loam about 4 inches thick. The upper 8 inches of the subsoil is brown very gravelly clay loam. The lower 14 inches is light olive brown very cobbly clay loam. Bedrock is at a depth of about 29 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is very cobbly or stony.

Included in this unit are small areas of Acker, Dubakella, and Norling soils; Rock outcrop and Pearsoll soils on ridges and convex slopes; Dumont soils on concave slopes and on the less sloping parts of the landscape; and, on concave slopes and foot slopes, soils that are similar to the Gravecreek soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Gravecreek soils that have slopes of less than 35 or more than 55 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately slow in the Gravecreek soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir. Other species that grow on this unit include incense cedar, Jeffrey pine, and Pacific madrone. The understory vegetation includes canyon live oak, common beargrass, and California fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 90. The yield at culmination of the mean annual increment is 4,200 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 31,840 board feet per acre (Scribner rule) at 160 years. On the basis of a 50-year curve, the mean site index is 65.

The main limitations affecting timber production are the slope, erosion, compaction, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. In some areas stones on the surface can cause breakage of falling timber and can hinder yarding. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer during summer, the low available water capacity, and a nutrient imbalance caused by the serpentinitic rock increase the seedling mortality rate. The large number of rock fragments in the soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced by providing artificial shade for seedlings. Reforestation can be accomplished by planting Jeffrey pine, ponderosa pine, and Douglas fir seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The vegetative site is Douglas Fir-Beargrass Forest, Serpentine.

75G—Gravecreek cobbly loam, 55 to 80 percent south slopes. This moderately deep, well drained soil is on hillslopes. It formed in colluvium derived from serpentinitic rock. Elevation is 2,200 to 4,300 feet. The mean annual precipitation is 45 to 55 inches, the mean annual temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is very dark grayish brown cobbly loam about 3 inches thick. The next layer is dark brown gravelly loam about 4 inches thick. The upper 8 inches of the subsoil is brown very gravelly clay loam. The lower 14 inches is light olive brown very cobbly clay loam. Bedrock is at a depth of about 29 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is very cobbly or stony.

Included in this unit are small areas of Acker, Dubakella, and Norling soils; Rock outcrop and Pearsoll soils on ridges and convex slopes; and soils that are similar to the Gravecreek soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Gravecreek soils that have slopes of less than 55 or more than 80 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately slow in the Gravecreek soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir. Other species that grow on this unit include incense cedar, Jeffrey pine, and Pacific madrone. The understory vegetation includes canyon live oak, common beargrass, and California fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 90. The yield at culmination of the mean annual increment is 4,200 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 31,840 board feet per acre (Scribner rule) at 160 years. On the basis of a 50-year curve, the mean site index is 65.

The main limitations affecting timber production are the slope, erosion, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

The slope restricts the use of wheeled and tracked logging equipment. High-lead or other cable systems are the best methods of logging. In some areas stones on the surface can cause breakage of falling timber and can hinder yarding. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Ripping landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Road cuts on this unit expose a large amount of fractured bedrock, which limits the response to seeding and mulching. Cut slopes are subject to slumping where the bedrock is highly fractured or where rock layers are parallel to the slopes. Steep yarding paths and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both.

Building logging roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer during summer, the low available water capacity, and a nutrient imbalance caused by the serpentinitic rock increase the seedling mortality rate. The large number of rock fragments in the soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced by providing artificial shade for seedlings. Reforestation can be accomplished by planting Jeffrey pine, ponderosa pine, and Douglas fir seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The vegetative site is Douglas Fir-Beargrass Forest, Serpentine.

76A—Gregory silty clay loam, 0 to 3 percent slopes. This deep, poorly drained soil is on stream terraces. It formed in alluvium derived dominantly from metamorphic rock. Elevation is 1,000 to 2,000 feet. The mean annual precipitation is 18 to 30 inches, the mean annual temperature is 50 to 54 degrees F, and the average frost-free period is 150 to 180 days. The native vegetation is mainly grasses, sedges, and forbs.

Typically, the surface layer is very dark grayish brown silty clay loam about 7 inches thick. The next layer is very dark grayish brown clay loam about 5 inches thick. The upper 6 inches of the subsoil also is very dark grayish brown clay loam. The lower 26 inches is very dark grayish brown and dark grayish brown clay. The substratum is dark grayish brown sandy clay loam about 6 inches thick. Weathered bedrock is at a depth of about 50 inches. The depth to bedrock ranges from 40 to 60 inches.

Included in this unit are small areas of Coleman and Medford soils on the higher terraces; Brader, Debenger, and Langellain soils on convex slopes; Cove and Padigan soils; and soils that are similar to the Gregory soil but have bedrock at a depth of less than 40 or more than 60 inches. Also included are small areas of Gregory soils that have slopes of more than 3 percent. Included areas make up about 20 percent of the total acreage.

Permeability is slow in the Gregory soil. Available water capacity is about 9 inches. The effective rooting depth is limited by the water table, which is within a depth of 1 foot from December through May. Runoff is slow, and the hazard of water erosion is slight.

This unit is used mainly for pasture. It also is used for irrigated crops, such as tree fruit, small grain, and corn for silage. A few areas are used for grass-legume hay or for homesite development.

This unit is suited to permanent pasture. It is limited mainly by the wetness, the high content of clay, and a slow rate of water intake. Crops that require good drainage can be grown if a properly designed drainage system is installed. The ability of tile drains to remove subsurface water from the soil is limited because of the slow permeability.

In summer, irrigation is needed for the maximum production of most forage crops. Sprinkler irrigation is the best method of applying water. Furrow, border, corrugation, and trickle irrigation systems also are suitable. The system used generally is governed by the crop that is grown. For the efficient application and removal of surface irrigation water, land leveling is needed. Because of the slow permeability and the water table, water applications should be regulated so that the water does not stand on the surface and damage the crop. Land smoothing and open ditches can reduce surface wetness. The use of pipe, ditch lining, or drop structures in irrigation ditches reduces water loss and the hazard of erosion.

Wetness limits the choice of suitable forage plants and the period of cutting or grazing and increases the risk of winterkill. The high content of clay severely limits tillage and root growth. Deep cracks form as the soil dries in summer. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

Solid-set sprinkler irrigation is the best method of controlling frost and providing adequate moisture for tree fruit. Compaction can be minimized by limiting the use of equipment when the soil is wet and by planting a cover crop. A permanent sod crop helps to control runoff.

This unit is poorly suited to homesite development. The main limitations are the wetness, a high shrink-swell potential, the slow permeability, and low strength.

This unit is poorly suited to standard systems of waste disposal because of the wetness and the slow permeability. Alternative waste disposal systems may function properly on this unit. Suitable included soils are throughout the unit. Onsite investigation is needed to locate such soils.

A drainage system is needed if roads or building foundations are constructed on this unit. The wetness can be reduced by installing drainage tile around footings. Properly designing foundations and footings, diverting runoff away from the buildings, and backfilling with material that has a low shrink-swell potential help to prevent the structural damage caused by shrinking and swelling. Properly designing buildings and roads helps to offset the limited ability of the soil to support a load.

Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. In many areas it may be necessary to haul in topsoil for lawns and gardens. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

The vegetative site is Poorly Drained Bottom.

77F—Greystoke stony loam, 35 to 55 percent north slopes. This deep, well drained soil is on hillslopes. It formed in colluvium derived from andesite. Elevation is 3,000 to 4,800 feet. The mean annual precipitation is 20 to 30 inches, the mean annual temperature is 42 to 46 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles and twigs about 1 inch thick. The surface layer is dark reddish brown stony loam about 3 inches thick. The next layer is dark reddish brown very cobbly loam about 10 inches thick. The upper 10 inches of the subsoil also is dark reddish brown very cobbly loam. The lower 19 inches is dark reddish brown extremely gravelly clay loam. Weathered bedrock is at a depth of about 42 inches. The depth to bedrock ranges from 40 to 60 inches.

Included in this unit are small areas of Merlin and Royst soils, Rock outcrop and Rubble land on ridges and convex slopes, Pinehurst soils on the less sloping parts of the landscape, and soils that are similar to the Greystoke soil but have bedrock at a depth of more than 60 inches. Also included are small areas of Greystoke soils that have slopes of less than 35 or more than 55 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately slow in the Greystoke soil. Available water capacity is about 4 inches. The effective rooting depth is 40 to 60 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include incense cedar, white fir, and sugar pine. The understory vegetation includes tall Oregon grape, pachystima, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 90. The yield at culmination of the mean annual increment is 4,200 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 31,840 board feet per acre (Scribner rule) at 160 years. On the basis of a 50-year curve, the mean site index is 65.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 90. The yield at culmination of the mean annual increment is 3,400 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 37,960 board feet per acre (Scribner rule) at 130 years.

The main limitations affecting timber production are the slope, erosion, compaction, and plant competition. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Building the roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting ponderosa pine and Douglas fir seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The main limitations affecting livestock grazing are erosion, compaction, and the slope. The native vegetation suitable for grazing includes western fescue, mountain brome, and tall trisetum. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Douglas Fir-Mixed Pine-Sedge Forest.

77G—Greystoke stony loam, 55 to 75 percent north slopes. This deep, well drained soil is on hillslopes. It formed in colluvium derived from andesite. Elevation is 3,000 to 4,800 feet. The mean annual precipitation is 20 to 30 inches, the mean annual temperature is 42 to 46 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles and twigs about 1 inch thick. The surface layer is dark reddish brown stony loam about 3 inches thick. The next layer is dark reddish brown very cobbly loam about 10 inches thick. The upper 10 inches of the subsoil also is dark reddish brown very cobbly loam. The lower 19 inches is dark reddish brown extremely gravelly clay loam. Weathered bedrock is at a depth of about 42 inches. The depth to bedrock ranges from 40 to 60 inches.

Included in this unit are small areas of Merlin and Royst soils, Rock outcrop and Rubble land on ridges and convex slopes, Pinehurst soils on the less sloping parts of the landscape, and soils that are similar to the Greystoke soil but have bedrock at a depth of more than 60 inches. Also included are small areas of Greystoke soils that have slopes of less than 55 or more than 75 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately slow in the Greystoke soil. Available water capacity is about 4 inches. The effective rooting depth is 40 to 60 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include incense cedar, white fir, and sugar pine. The understory vegetation includes tall Oregon grape, pachystima, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 90. The yield at culmination of the mean annual increment is 4,200 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 31,840 board feet per acre (Scribner rule) at 160 years. On the basis of a 50-year curve, the mean site index is 65.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 90. The yield at culmination of the mean annual increment is 3,400 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 37,960 board feet per acre (Scribner rule) at 130 years.

The main limitations affecting timber production are the slope, erosion, and plant competition. The slope restricts the use of wheeled and tracked logging equipment. High-lead or other cable systems are the best methods of logging. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Ripping landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Road cuts can expose a large amount of fractured bedrock, which limits the response to seeding and mulching. Steep yarding paths and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

Building logging roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting ponderosa pine and Douglas fir seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The main limitations affecting livestock grazing are erosion, compaction, and the slope. The native vegetation suitable for grazing includes western fescue, mountain brome, and tall trisetum. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Douglas Fir-Mixed Pine-Sedge Forest.

78F—Greystoke stony loam, 35 to 55 percent south slopes. This deep, well drained soil is on hillslopes. It formed in colluvium derived from andesite. Elevation is 3,000 to 5,200 feet. The mean annual precipitation is 20 to 30 inches, the mean annual temperature is 42 to 46 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles and twigs about 1 inch thick. The surface layer is dark reddish brown stony loam about 3 inches thick. The next layer is dark reddish brown very cobbly loam about 10 inches thick. The upper 10 inches of the subsoil also is dark reddish brown very cobbly loam. The lower 19 inches is dark reddish brown extremely gravelly clay loam. Weathered bedrock is at a depth of about 42 inches. The depth to bedrock ranges from 40 to 60 inches.

Included in this unit are small areas of Merlin and Royst soils, Rock outcrop and Rubble land on ridges and convex slopes, Pinehurst soils on the less sloping parts of the landscape, and soils that are similar to the Greystoke soil but have bedrock at a depth of more than 60 inches. Also included are small areas of Greystoke soils that have slopes of less than 35 or more than 55 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately slow in the Greystoke soil. Available water capacity is about 4 inches. The effective rooting depth is 40 to 60 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include incense cedar, white fir, and sugar pine.

The understory vegetation includes tall Oregon grape, pachystima, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 85. The yield at culmination of the mean annual increment is 4,480 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years and 27,520 board feet per acre (Scribner rule) at 160 years. On the basis of a 50-year curve, the mean site index is 60.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 80. The yield at culmination of the mean annual increment is 2,670 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 33,750 board feet per acre (Scribner rule) at 150 years.

The main limitations affecting timber production are the slope, erosion, compaction, seedling mortality, and plant competition. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Building the roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. The large number of rock fragments in the soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced by providing artificial shade for seedlings. Reforestation can be accomplished by planting ponderosa pine and Douglas fir seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The main limitations affecting livestock grazing are erosion, compaction, and the slope. The native vegetation suitable for grazing includes western fescue, mountain brome, and tall trisetum. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Douglas Fir-Mixed Pine-Sedge Forest.

79E—Greystoke-Pinehurst complex, 12 to 35 percent north slopes. This map unit is on hillslopes. Elevation is 3,500 to 4,800 feet. The mean annual precipitation is 20 to 30 inches, the mean annual temperature is 42 to 46 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

This unit is about 60 percent Greystoke soil and 25 percent Pinehurst soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Merlin and Royst soils and Rock outcrop on ridges and convex slopes, Kanutchan soils near drainageways and on concave slopes, and soils that are similar to the Pinehurst soil but have bedrock within a depth of 60 inches. Also included are small areas of Greystoke and Pinehurst soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 15 percent of the total acreage.

The Greystoke soil is deep and well drained. It formed in residuum and colluvium derived dominantly from andesite. Typically, the surface is covered with a layer of needles and twigs about 1 inch thick. The surface layer is dark reddish brown stony loam about 3 inches thick. The next layer is dark reddish brown very cobbly loam about 10 inches thick. The upper 10 inches of the subsoil also is dark reddish brown very cobbly loam. The lower 19 inches is dark reddish brown extremely gravelly clay loam. Weathered bedrock is at a depth of about 42 inches. The depth to bedrock ranges from 40 to 60 inches.

Permeability is moderately slow in the Greystoke soil. Available water capacity is about 4 inches. The effective rooting depth is 40 to 60 inches. Runoff is medium, and the hazard of water erosion is moderate.

The Pinehurst soil is very deep and well drained. It formed in colluvium derived dominantly from andesite. Typically, the surface is covered with a layer of needles and twigs about 1 inch thick. The surface layer is dark reddish brown loam about 15 inches thick. The subsoil is dark reddish brown clay loam about 45 inches thick. The depth to bedrock is 60 inches or more. In some areas the surface layer is stony.

Permeability is moderately slow in the Pinehurst soil. Available water capacity is about 10 inches. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include incense cedar, white fir, and sugar pine. The understory vegetation includes tall Oregon grape, pachystima, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 90 on the Greystoke soil. The yield at culmination of the mean annual increment is 4,200 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 31,840 board feet per acre (Scribner rule) at 160 years. On the basis of a 50-year curve, the mean site index is 65.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 90 on the Greystoke soil. The yield at culmination of the mean annual increment is 3,400 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 37,960 board feet per acre (Scribner rule) at 130 years.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 100 on the Pinehurst soil. The yield at culmination of the mean annual increment is 5,040 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 39,750 board feet per acre (Scribner rule) at 150 years. On the basis of a 50-year curve, the mean site index is 75.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 95 on the Pinehurst soil. The yield at culmination of the mean annual increment is 3,760 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 43,160 board feet per acre (Scribner rule) at 130 years.

The main limitations affecting timber production are erosion, compaction, and plant competition. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. If the soils are excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soils are moist causes rutting and compaction. Puddling can occur when the soils are wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting ponderosa pine and Douglas fir seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

Severe frost can damage or kill seedlings. In the less sloping areas where air drainage may be restricted, proper timber harvesting methods can reduce the effect of frost on regeneration.

The main limitations affecting livestock grazing are compaction and erosion. The native vegetation suitable for grazing includes western fescue, mountain brome, and tall trisetum. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soils. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Douglas Fir-Mixed Pine-Sedge Forest.

80E—Greystoke-Pinehurst complex, 12 to 35 percent south slopes. This map unit is on hillslopes. Elevation is 3,500 to 4,800 feet. The mean annual precipitation is 20 to 30 inches, the mean annual temperature is 42 to 46 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

This unit is about 60 percent Greystoke soil and 25 percent Pinehurst soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Merlin and Royst soils and Rock outcrop on ridges and convex slopes, Kanutchan soils near drainageways and on concave slopes, and soils that are similar to the Pinehurst soil but have bedrock within a depth of 60 inches. Also included are small areas of Greystoke and Pinehurst soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 15 percent of the total acreage.

The Greystoke soil is deep and well drained. It formed in colluvium derived dominantly from andesite. Typically, the surface is covered with a layer of needles and twigs about 1 inch thick. The surface layer is dark reddish brown stony loam about 3 inches thick. The next layer is dark reddish brown very cobbly loam about 10 inches thick. The upper 10 inches of the subsoil also is dark reddish brown very cobbly loam. The lower 19 inches is dark reddish brown extremely gravelly clay loam. Weathered bedrock is at a depth of about 42 inches. The depth to bedrock ranges from 40 to 60 inches.

Permeability is moderately slow in the Greystoke soil. Available water capacity is about 4 inches. The effective rooting depth is 40 to 60 inches. Runoff is medium, and the hazard of water erosion is moderate.

The Pinehurst soil is very deep and well drained. It formed in colluvium derived dominantly from andesite. Typically, the surface is covered with a layer of needles and twigs about 1 inch thick. The surface layer is dark reddish brown loam about 15 inches thick. The subsoil is dark reddish brown clay loam about 45 inches thick. The depth to bedrock is 60 inches or more. In some areas the surface layer is stony.

Permeability is moderately slow in the Pinehurst soil. Available water capacity is about 10 inches. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include incense cedar, white fir, and sugar pine. The understory vegetation includes tall Oregon grape, pachystima, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 85 on the Greystoke soil. The yield at culmination of the mean annual increment is 4,480 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years and 37,520 board feet per acre (Scribner rule) at 160 years. On the basis of a 50-year curve, the mean site index is 60.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 80 on the Greystoke soil. The yield at culmination of the mean annual increment is 2,670 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 33,750 board feet per acre (Scribner rule) at 150 years.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 95 on the Pinehurst soil. The yield at culmination of the mean annual increment is 4,620 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 37,120 board feet per acre (Scribner rule) at 160 years. On the basis of a 50-year curve, the mean site index is 65.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 85 on the Pinehurst soil. The yield at culmination of the mean annual increment is 3,080 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 38,700 board feet per acre (Scribner rule) at 150 years.

The main limitations affecting timber production are erosion, compaction, plant competition, and seedling mortality. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. If the soils are excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soils are moist causes rutting and compaction. Puddling can occur when the soils are wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting ponderosa pine and Douglas fir seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. The large number of rock fragments in the Greystoke soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings.

Severe frost can damage or kill seedlings. In the less sloping areas where air drainage may be restricted, proper timber harvesting methods can reduce the effect of frost on regeneration.

The main limitations affecting livestock grazing are compaction and erosion. The native vegetation suitable for grazing includes western fescue, mountain brome, and tall trisetum. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soils. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Douglas Fir-Mixed Pine-Sedge Forest.

81G—Heppsie clay, 35 to 70 percent north slopes. This moderately deep, well drained soil is on hillslopes. It formed in colluvium derived dominantly from tuff, breccia, and andesite. Elevation is 2,000 to 4,000 feet. The mean annual precipitation is 18 to 35 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 170 days. The native vegetation is mainly hardwoods and conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is very dark brown and very dark grayish brown clay about 15 inches thick. The subsoil is dark brown gravelly clay about 9 inches thick. Weathered bedrock is at a depth of about 24 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Included in this unit are small areas of Rock outcrop and McMullin soils; Carney and Medco soils on concave slopes and on the less sloping parts of the landscape; McNull, Skookum, and Tablerock soils; and, on ridges and convex slopes, soils that are similar to the Heppsie soil but have bedrock within a depth of 20 inches. Also included are small areas of Heppsie soils that have slopes of less than 35 or more than 70 percent. Included areas make up about 20 percent of the total acreage.

Permeability is slow in the Heppsie soil. Available water capacity is about 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for livestock grazing and wildlife habitat. The main limitations affecting livestock grazing are erosion, compaction, the slope, droughtiness, and the clayey surface layer. The vegetation suitable for grazing includes Idaho fescue, prairie junegrass, and California brome. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

This unit is poorly suited to range seeding. The main limitations are the slope, droughtiness, and the clayey surface layer. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

The slope limits access by livestock and results in overgrazing of the less sloping areas. Constructing trails or walkways allows livestock to graze in areas where access is limited.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment. The use of ground equipment is not practical because of stones on the surface and the slope.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the slope.

The vegetative site is Droughty North, 18- to 35-inch precipitation zone.

82G—Heppsie-McMullin complex, 35 to 70 percent south slopes. This map unit is on hillslopes. Elevation is 2,000 to 4,000 feet. The mean annual precipitation is 18 to 35 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 170 days. The native vegetation is mainly hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 60 percent Heppsie soil and 20 percent McMullin soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Rock outcrop; Carney and Medco soils on concave slopes and on the less sloping parts of the landscape; Skookum and Tablerock soils; and, on ridges and convex slopes, soils that are similar to the Heppsie soil but have bedrock within a depth of 20 inches. Also included are small areas of Heppsie soils that have slopes of less than 35 or more than 70 percent. Included areas make up about 20 percent of the total acreage.

The Heppsie soil is moderately deep and well drained. It formed in colluvium derived dominantly from tuff, breccia, and andesite. Typically, the surface layer is very dark brown and very dark grayish brown clay about 15 inches thick. The subsoil is dark brown gravelly clay about 9 inches thick. Weathered bedrock is at a depth of about 24 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Permeability is slow in the Heppsie soil. Available water capacity is about 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

The McMullin soil is shallow and well drained. It formed in colluvium derived dominantly from andesite. Typically, the surface layer is dark reddish brown gravelly loam about 7 inches thick. The subsoil is dark reddish brown gravelly clay loam about 10 inches thick. Bedrock is at a depth of about 17 inches. The depth to bedrock ranges from 12 to 20 inches. In some areas the surface layer is stony.

Permeability is moderate in the McMullin soil. Available water capacity is about 2 inches. The effective rooting depth is 12 to 20 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for livestock grazing and wildlife habitat. The main limitations affecting livestock grazing are erosion, compaction, the slope, and droughtiness. The McMullin soil also is limited by the depth to bedrock and the Heppsie soil by the clayey surface layer. The vegetation suitable for grazing includes Idaho fescue, prairie junegrass, bluebunch wheatgrass, and pine bluegrass. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment. The use of ground equipment is not practical because of stones on the surface and the slope.

This unit is poorly suited to range seeding. The main limitations are the slope, droughtiness, the depth to bedrock in the McMullin soil, and the clayey surface layer of the Heppsie soil. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

The slope limits access by livestock and results in overgrazing of the less sloping areas. Constructing trails or walkways allows livestock to graze in areas where access is limited.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the slope of both soils and the depth to bedrock in the McMullin soil.

The vegetative site in areas of the Heppsie soil is Loamy Hills, 20- to 35-inch precipitation zone, and the one in areas of the McMullin soil is Shallow Mountain Slopes, 22- to 30-inch precipitation zone.

83E—Hobit loam, 12 to 35 percent north slopes. This moderately deep, well drained soil is on hillslopes. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Elevation is 5,000 to 6,000 feet. The mean annual precipitation is 30 to 50 inches, the mean annual temperature is 40 to 44 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles and twigs about 1 inch thick. The surface layer is very dark brown loam about 18 inches thick. The subsoil also is very dark brown loam. It is about 8 inches thick. The substratum is dark yellowish brown gravelly clay loam about 9 inches thick. Weathered bedrock is at a depth of about 35 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Included in this unit are small areas of Tatouche soils, Bybee soils on concave slopes and on the less sloping parts of the landscape, soils that are similar to the Hobit soil but have bedrock at a depth of less than 20 or more than 40 inches or have more than 35 percent rock fragments, and poorly drained soils near drainageways and on concave slopes. Also included are small areas of Hobit soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderate in the Hobit soil. Available water capacity is about 7 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of white fir. Other species that grow on this unit include Douglas fir, incense cedar, and Rocky Mountain maple. The understory vegetation includes cascade Oregongrape, common snowberry, and gooseberry.

On the basis of a 50-year site curve, the mean site index for white fir is 70. The yield at culmination of the mean annual increment is 11,410 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years.

The main limitations affecting timber production are erosion, compaction, plant competition, and seedling mortality. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting ponderosa pine and white fir seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

Severe frost can damage or kill seedlings. In the less sloping areas where air drainage may be restricted, proper timber harvesting methods can reduce the effect of frost on regeneration.

The main limitations affecting livestock grazing are compaction and erosion. The native vegetation suitable for grazing includes Canada bluegrass, Alaska oniongrass, and mountain brome. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion. The seedling survival rate may be low, however, because of cold temperatures in spring.

The vegetative site is White Fir Forest.

83G—Hobit loam, 35 to 60 percent north slopes. This moderately deep, well drained soil is on hillslopes. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Elevation is 5,000 to 6,000 feet. The mean annual precipitation is 30 to 50 inches, the mean annual temperature is 40 to 44 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles and twigs about 1 inch thick. The surface layer is very dark brown loam about 18 inches thick. The subsoil also is very dark brown loam. It is about 8 inches thick. The substratum is dark yellowish brown gravelly clay loam about 9 inches thick. Weathered bedrock is at a depth of about 35 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Included in this unit are small areas of Tatouche soils, Woodseye soils and Rock outcrop on ridges and convex slopes, soils that are similar to the Hobit soil but have bedrock at a depth of less than 20 or more than 40 inches or have more than 35 percent rock fragments, and poorly drained soils near drainageways and on concave slopes. Also included are small areas of Hobit soils that have slopes of less than 35 or more than 60 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderate in the Hobit soil. Available water capacity is about 7 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of white fir. Other species that grow on this unit include Douglas fir, incense cedar, and Rocky Mountain maple. The understory vegetation includes cascade Oregongrape, common snowberry, and gooseberry.

On the basis of a 50-year site curve, the mean site index for white fir is 70. The yield at culmination of the mean annual increment is 11,410 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years.

The main limitations affecting timber production are the slope, erosion, compaction, plant competition, and seedling mortality. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Building the roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting ponderosa pine and white fir seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

Severe frost can damage or kill seedlings. Proper timber harvesting methods can reduce the effect of frost on regeneration.

The main limitations affecting livestock grazing are erosion, compaction, and the slope. The native vegetation suitable for grazing includes Canada bluegrass, Alaska oniongrass, and mountain brome. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion. The seedling survival rate may be low, however, because of cold temperatures in spring.

The vegetative site is White Fir Forest.

84E—Hobit loam, 12 to 35 percent south slopes. This moderately deep, well drained soil is on hillslopes. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Elevation is 5,000 to 6,000 feet. The mean annual precipitation is 30 to 50 inches, the mean annual temperature is 40 to 44 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles and twigs about 1 inch thick. The surface layer is very dark brown loam about 18 inches thick. The subsoil also is very dark brown loam. It is about 8 inches thick. The substratum is dark yellowish brown gravelly clay loam about 9 inches thick. Weathered bedrock is at a depth of about 35 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Included in this unit are small areas of Tatouche soils, Bybee soils on concave slopes and on the less sloping parts of the landscape, soils that are similar to the Hobit soil but have bedrock at a depth of less than 20 or more than 40 inches, poorly drained soils near drainageways and on concave slopes, and soils that are similar to the Hobit soil but have more than 35 percent rock fragments. Also included are small areas of Hobit soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderate in the Hobit soil. Available water capacity is about 7 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of white fir and Douglas fir. Other species that grow on this unit include incense cedar. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and common snowberry.

On the basis of a 50-year site curve, the mean site index for white fir is 65. The yield at culmination of the mean annual increment is 10,150 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years.

The main limitations affecting timber production are erosion, compaction, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Severe frost can damage or kill seedlings. In the less sloping areas where air drainage may be restricted, proper timber harvesting methods can reduce the effect of frost on regeneration.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The main limitations affecting livestock grazing are compaction and erosion. The native vegetation suitable for grazing includes western fescue, mountain brome, tall trisetum, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Serviceberry Forest.

84G—Hobit loam, 35 to 60 percent south slopes. This moderately deep, well drained soil is on hillslopes. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Elevation is 5,000 to 6,000 feet. The mean annual precipitation is 30 to 50 inches, the mean annual temperature is 40 to 44 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles and twigs about 1 inch thick. The surface layer is very dark brown loam about 18 inches thick. The subsoil also is very dark brown loam. It is about 8 inches thick. The substratum is dark yellowish brown gravelly clay loam about 9 inches thick. Weathered bedrock is at a depth of about 35 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Included in this unit are small areas of Tatouche soils, Woodseye soils and Rock outcrop on ridges and convex slopes, soils that are similar to the Hobit soil but have bedrock at a depth of less than 20 or more than 40 inches or have more than 35 percent rock fragments, and poorly drained soils near drainageways and on concave slopes. Also included are small areas of Hobit soils that have slopes of less than 35 or more than 60 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderate in the Hobit soil. Available water capacity is about 7 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of white fir and Douglas fir. Other species that grow on this unit include incense cedar. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and common snowberry.

On the basis of a 50-year site curve, the mean site index for white fir is 65. The yield at culmination of the mean annual increment is 10,150 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years.

The main limitations affecting timber production are the slope, erosion, compaction, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Displacement of the surface layer occurs most readily when the soil is dry. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Building the roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced by providing artificial shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Severe frost can damage or kill seedlings. Proper timber harvesting methods can reduce the effect of frost on regeneration.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The main limitations affecting livestock grazing are erosion, compaction, and the slope. The native vegetation suitable for grazing includes western fescue, mountain brome, tall trisetum, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Serviceberry Forest.

85A—Hoxie silt loam, 0 to 1 percent slopes. This very deep, poorly drained soil is in basins. It formed in lacustrine sediment derived dominantly from volcanic ash. Elevation is 4,300 to 5,000 feet. The mean annual precipitation is 30 to 40 inches, the mean annual temperature is 40 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly grasses, sedges, and forbs.

Typically, the surface layer is black silt loam about 10 inches thick. The next 4 inches also is black silt loam. The upper 14 inches of the subsoil is grayish brown silt loam. The lower 16 inches is grayish brown very fine sandy loam and silt loam. The substratum to a depth of 65 inches is grayish brown silt loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is stony or cobbly.

Included in this unit are small areas of Kanutchan soils; very poorly drained, organic soils; and soils that are similar to the Hoxie soil but have a subsoil of clay. Included areas make up about 10 percent of the total acreage.

Permeability is moderate in the Hoxie soil. Available water capacity is about 13 inches. The effective rooting depth is limited by the water table, which is within a depth of 3 feet from March through June. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for pasture and wildlife habitat. The main limitations affecting livestock grazing are the seasonal wetness, a short growing season, and compaction. The wetness limits the choice of suitable forage plants and the period of cutting or grazing and increases the risk of winterkill.

If the pasture is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. The grazing system should maintain the desired balance of species in the plant community. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth.

Tufted hairgrass is the native plant preferred for livestock grazing; however, this unit can be renovated and forage production increased by seeding other suitable grasses. The plants selected for seeding should be those that are tolerant of a cold climate and wetness. Border and contour flood irrigation systems are suitable. Land leveling helps to ensure a uniform application of water. Fertilizer is needed to ensure the optimum growth of grasses. Grasses respond to nitrogen.

The vegetative site is Wet Meadow.

86C—Hukill gravelly loam, 1 to 12 percent slopes. This deep, well drained soil is on plateaus. It formed in residuum and colluvium derived from andesite.

Elevation is 2,000 to 3,000 feet. The mean annual precipitation is 30 to 45 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 150 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about 1/2 inch thick. The surface layer is dark reddish brown gravelly loam about 2 inches thick. The next layer is dark reddish brown gravelly clay loam about 4 inches thick. The upper 5 inches of the subsoil also is dark reddish brown gravelly clay loam. The lower 31 inches is dark reddish brown gravelly clay. Weathered bedrock is at a depth of about 42 inches. The depth to bedrock ranges from 40 to 60 inches. In some areas the surface layer is stony.

Included in this unit are small areas of Freezener soils, Terrabella soils near drainageways and on concave slopes, Geppert soils on convex slopes and on the more sloping parts of the landscape, and soils that are similar to the Hukill soil but have bedrock within a depth of 40 inches. Also included are small areas of Hukill soils that have slopes of more than 12 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderately slow in the Hukill soil. Available water capacity is about 7 inches. The effective rooting depth is 40 to 60 inches. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir. Other species that grow on this unit include sugar pine, ponderosa pine, white fir, and California black oak. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 110. The yield at culmination of the mean annual increment is 5,880 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 48,300 board feet per acre (Scribner rule) at 140 years. On the basis of a 50-year curve, the mean site index is 75.

The main limitations affecting timber production are compaction, erosion, and plant competition. Conventional methods of harvesting timber generally are suitable, but the soil may be compacted if it is moist when heavy equipment is used. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Erosion can be controlled by carefully planning the construction and maintenance of logging roads, skid trails, and landings. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

Severe frost can damage or kill seedlings. Air drainage may be restricted on this unit. Proper timber harvesting methods can reduce the effect of frost on regeneration.

The main limitation affecting livestock grazing is compaction. The native vegetation suitable for grazing includes western fescue, mountain brome, tall trisetum, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Mixed Pine Forest.

87F—Jayar very gravelly loam, 12 to 45 percent north slopes. This moderately deep, well drained soil is on hillslopes. It formed in colluvium derived dominantly from metamorphic rock. Elevation is 3,600 to 5,300 feet. The mean annual precipitation is 40 to 60 inches, the mean annual temperature is 40 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is very dark grayish brown very gravelly loam about 5 inches thick. The next layer is dark brown very gravelly loam about 6 inches thick. The subsoil also is dark brown very gravelly loam. It is about 13 inches thick. Bedrock is at a depth of about 24 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Included in this unit are small areas of Woodseye soils and Rock outcrop on ridges and convex slopes and small areas of soils that are similar to the Jayar soil but are influenced by serpentine, have less than 35 percent rock fragments, or have bedrock at a depth of more than 40 inches. Also included are small areas of Jayar soils that have slopes of less than 12 or more than 45 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderate in the Jayar soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium or rapid, and the hazard of water erosion is moderate or high.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir and white fir. Other species that grow on this unit include incense cedar and ponderosa pine. The understory vegetation includes creambush oceanspray, cascade Oregongrape, and whitevein shinleaf.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 100. The yield at culmination of the mean annual increment is 5,040 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 39,750 board feet per acre (Scribner rule) at 150 years. On the basis of a 50-year curve, the mean site index is 80

The main limitations affecting timber production are erosion, compaction, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Road cuts on this unit expose a large amount of fractured bedrock, which limits the response to seeding and mulching. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. The large number of rock fragments in the soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. Reforestation can be accomplished by planting Douglas fir seedlings.

Severe frost can damage or kill seedlings. In the less sloping areas where air drainage may be restricted, proper timber harvesting methods can reduce the effect of frost on regeneration.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The vegetative site is Mixed Fir-Oceanspray Forest.

87G—Jayar very gravelly loam, 45 to 70 percent north slopes. This moderately deep, well drained soil is on hillslopes. It formed in colluvium derived dominantly from metamorphic rock. Elevation is 3,600 to 5,300 feet. The mean annual precipitation is 40 to 60 inches, the mean annual temperature is 40 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is very dark grayish brown very gravelly loam about 5 inches thick. The next layer is dark brown very gravelly loam about 6 inches thick. The subsoil also is dark brown very gravelly loam. It is about 13 inches thick. Bedrock is at a depth of about 24 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Included in this unit are small areas of Woodseye soils and Rock outcrop on ridges and convex slopes and soils that are similar to the Jayar soil but are influenced by serpentine, have less than 35 percent rock fragments, or have bedrock at a depth of more than 40 inches. Also included are small areas of Jayar soils that have slopes of less than 45 or more than 70 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderate in the Jayar soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir and white fir. Other species that grow on this unit include incense cedar and ponderosa pine. The understory vegetation includes creambush oceanspray, cascade Oregongrape, and whitevein shinleaf.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 100. The yield at culmination of the mean annual increment is 5,040 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 39,750 board feet per acre (Scribner rule) at 150 years. On the basis of a 50-year curve, the mean site index is 80.

The main limitations affecting timber production are the slope, erosion, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

The slope restricts the use of wheeled and tracked logging equipment. High-lead or other cable systems are the best methods of logging. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Ripping landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Road cuts can expose a large amount of fractured bedrock, which limits the response to seeding and mulching. Cut slopes are subject to slumping where the bedrock is highly fractured or where rock layers are parallel to the slopes. Steep yarding paths and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both.

Building logging roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Severe frost can damage or kill seedlings. A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. The large number of rock fragments in the soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. Reforestation can be accomplished by planting Douglas fir seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The vegetative site is Mixed Fir-Oceanspray Forest.

88F—Jayar very gravelly loam, 12 to 45 percent south slopes. This moderately deep, well drained soil is on hillslopes. It formed in colluvium derived dominantly from metamorphic rock. Elevation is 3,600 to 5,300 feet. The mean annual precipitation is 40 to 60 inches, the mean annual temperature is 40 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is very dark grayish brown very gravelly loam about 5 inches thick. The next layer is dark brown very gravelly loam about 6 inches thick. The subsoil also is dark brown very gravelly loam. It is about 13 inches thick. Bedrock is at a depth of about 24 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Included in this unit are small areas of Woodseye soils and Rock outcrop on ridges and convex slopes and small areas of soils that are similar to the Jayar soil but are influenced by serpentine, have less than 35 percent rock fragments, or have bedrock at a depth of more than 40 inches. Also included are small areas of Jayar soils that have slopes of less than 12 or more than 45 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderate in the Jayar soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium or rapid, and the hazard of water erosion is moderate or high.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir and white fir. Other species that grow on this unit include incense cedar and ponderosa pine. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and common snowberry.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 90. The yield at culmination of the mean annual increment is 4,200 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 31,840 board feet per acre (Scribner rule) at 160 years. On the basis of a 50-year curve, the mean site index is 70.

The main limitations affecting timber production are erosion, compaction, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Road cuts on this unit expose a large amount of fractured bedrock, which limits the response to seeding and mulching. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. The large number of rock fragments in the soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced by providing artificial shade for seedlings. Reforestation can be accomplished by planting Douglas fir seedlings.

Severe frost can damage or kill seedlings. In the less sloping areas where air drainage may be restricted, proper timber harvesting methods can reduce the effect of frost on regeneration.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The vegetative site is Mixed Fir-Serviceberry Forest.

89E—Jayar Variant very gravelly loam, 5 to 35 percent slopes. This moderately deep, well drained soil is on ridges and hillslopes. It formed in colluvium derived dominantly from metamorphic rock. Elevation is 4,700 to 5,300 feet. The mean annual precipitation is 50 to 60 inches, the mean annual temperature is 40 to 44 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is very dark brown and dark brown very gravelly loam about 8 inches thick. The subsoil is dark yellowish brown very cobbly loam about 16 inches thick. Bedrock is at a depth of about 24 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Included in this unit are small areas of Woodseye soils and Rock outcrop on convex slopes and small areas of soils that are similar to the Jayar Variant soil but are influenced by serpentine, have less than 35 percent rock fragments, or have bedrock at a depth of more than 40 inches. Also included are small areas of Jayar Variant soils that have slopes of less than 5 or more than 35 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderate in the Jayar Variant soil. Available water capacity is about 2 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for timber production and wildlife habitat. It is suited to the production of white fir and noble fir. Other species that grow on this unit include incense cedar and Douglas fir. The understory vegetation includes sierra chinkapin, currant, and pinemat manzanita.

On the basis of a 50-year site curve, the mean site index for white fir is 50. The yield at culmination of the mean annual increment is 6,370 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years and 58,200 board feet per acre (Scribner rule) at 120 years.

The main limitations affecting timber production are erosion, compaction, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Road cuts can expose a large amount of fractured bedrock, which limits the response to seeding and mulching. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Severe frost can damage or kill seedlings. Seedling mortality is higher on ridgetops, which are more exposed to cold winds than other parts of the landscape. Proper timber harvesting methods can reduce the effect of frost on regeneration.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. The large number of rock fragments in the soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The vegetative site is Noble Fir-Bush Chinkapin Forest.

90E—Josephine-Pollard complex, 12 to 35 percent north slopes. This map unit is on hillslopes and alluvial fans. Elevation is 1,200 to 4,000 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 45 percent Josephine soil and 40 percent Pollard soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Dubakella, Goolaway, Siskiyou, Speaker, and Wolfpeak soils; Abegg soils on alluvial fans and along drainageways; Beekman soils on the more sloping parts of the landscape and on convex slopes; poorly drained soils near drainageways and on concave slopes; and soils that are similar to the Josephine and Pollard soils but have more than 35 percent rock fragments. Also included are small areas of Josephine and Pollard soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 15 percent of the total acreage.

The Josephine soil is deep and well drained. It formed in colluvium and residuum derived dominantly from metamorphic rock. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is dark reddish brown gravelly loam about 15 inches thick. The subsoil is dark reddish brown and reddish brown gravelly clay loam about 40 inches thick. Weathered bedrock is at a depth of about 55 inches. The depth to bedrock ranges from 40 to 60 inches. In some areas the surface layer is clay loam.

Permeability is moderately slow in the Josephine soil. Available water capacity is about 7 inches. The effective rooting depth is 40 to 60 inches. Runoff is medium, and the hazard of water erosion is moderate.

The Pollard soil is very deep and well drained. It formed in alluvium and colluvium derived dominantly from metamorphic rock. Typically, the surface is covered with a layer of needles, leaves, and twigs about 2 inches thick. The surface layer is dark brown loam about 11 inches thick. The upper 25 inches of the subsoil is dark reddish brown clay loam. The lower 25 inches is yellowish red and brown clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is clay loam or gravelly loam.

Permeability is slow in the Pollard soil. Available water capacity is about 7 inches. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir. Other species that grow on this unit include ponderosa pine, incense cedar, and golden chinkapin. The understory vegetation includes creambush oceanspray, cascade Oregongrape, and deerfoot vanillaleaf.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 130 on both the Josephine and Pollard soils. The yield at culmination of the mean annual increment is 7,740 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 58,520 board feet per acre (Scribner rule) at 110 years. On the basis of a 50-year curve, the mean site index is 95.

The main limitations affecting timber production are erosion, compaction, slumping, and plant competition. Using standard wheeled and tracked equipment when the soils are moist causes rutting and compaction. Puddling can occur when the soils are wet. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both.

The Pollard soil is subject to slumping. Road failure and landslides are likely to occur after road construction and clearcutting. Slumping can be minimized by constructing logging roads in the less sloping areas, on better suited soils if practical, and by installing properly designed road drainage systems. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The vegetative site is Douglas Fir-Chinkapin Forest.

91E—Josephine-Pollard complex, 12 to 35 percent south slopes. This map unit is on hillslopes and alluvial fans. Elevation is 1,200 to 4,000 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 55 percent Josephine soil and 30 percent Pollard soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Abegg soils on alluvial fans and near drainageways; Beekman soils on the more sloping parts of the landscape and on convex slopes; poorly drained soils near drainageways and on concave slopes; Dubakella, Goolaway, Speaker, and Wolfpeak soils; and soils that are similar to the Josephine and Pollard soils but have more than 35 percent rock fragments. Also included are small areas of Josephine and Pollard soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 15 percent of the total acreage.

The Josephine soil is deep and well drained. It formed in colluvium and residuum derived dominantly from metamorphic rock. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is dark reddish brown gravelly loam about 15 inches thick. The subsoil is dark reddish brown and reddish brown gravelly clay loam about 40 inches thick. Weathered bedrock is at a depth of about 55 inches. The depth to bedrock ranges from 40 to 60 inches. In some areas the surface layer is clay loam.

Permeability is moderately slow in the Josephine soil. Available water capacity is about 7 inches. The effective rooting depth is 40 to 60 inches. Runoff is medium, and the hazard of water erosion is moderate.

The Pollard soil is very deep and well drained. It formed in alluvium and colluvium derived dominantly from metamorphic rock. Typically, the surface is covered with a layer of needles, leaves, and twigs about 2 inches thick. The surface layer is dark brown loam about 11 inches thick. The upper 25 inches of the subsoil is dark reddish brown clay loam. The lower 25 inches is yellowish red and brown clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is clay loam or gravelly loam.

Permeability is slow in the Pollard soil. Available water capacity is about 7 inches. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include sugar pine and California black oak. The understory vegetation includes canyon live oak, deerbrush, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 120 on the Josephine soil. The yield at culmination of the mean annual increment is 6,900 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 52,440 board feet per acre (Scribner rule) at 120 years. On the basis of a 50-year curve, the mean site index is 90.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 125 on the Pollard soil. The yield at culmination of the mean annual increment is 7,320 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 58,200 board feet per acre (Scribner rule) at 120 years. On the basis of a 50-year curve, the mean site index is 90.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 115 on both the Josephine and Pollard soils. The yield at culmination of the mean annual increment is 5,280 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 56,870 board feet per acre (Scribner rule) at 110 years.

The main limitations affecting timber production are erosion, compaction, slumping, seedling mortality, and plant competition. Using standard wheeled and tracked equipment when the soils are moist causes rutting and compaction. Puddling can occur when the soils are wet. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

The Pollard soil is subject to slumping. Road failure and landslides are likely to occur after road construction and clearcutting. Clearcutting increases the hazard of slumping on this unit. Slumping can be minimized by constructing logging roads in the less sloping areas, on better suited soils if practical, and by installing properly designed road drainage systems. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced by providing artificial shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The vegetative site is Douglas Fir-Black Oak Forest.

92E—Josephine-Speaker complex, 12 to 35 percent north slopes. This map unit is on hillslopes. Elevation is 1,200 to 4,000 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 55 percent Josephine soil and 25 percent Speaker soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Dubakella, Goolaway, and Wolfpeak soils; Abegg soils on alluvial fans and near drainageways; Pollard soils on concave slopes; Beekman soils on the more sloping parts of the landscape and on convex slopes; poorly drained soils near drainageways and on concave slopes; and soils that are similar to the Josephine and Speaker soils but have more than 35 percent rock fragments. Also included are small areas of Josephine and Speaker soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 20 percent of the total acreage.

The Josephine soil is deep and well drained. It formed in colluvium and residuum derived dominantly from metamorphic rock. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is dark reddish brown gravelly loam about 15 inches thick. The subsoil is dark reddish brown and reddish brown gravelly clay loam about 40 inches thick. Weathered bedrock is at a depth of about 55 inches. The depth to bedrock ranges from 40 to 60 inches. In some areas the surface layer is clay loam.

Permeability is moderately slow in the Josephine soil. Available water capacity is about 7 inches. The effective rooting depth is 40 to 60 inches. Runoff is medium, and the hazard of water erosion is moderate.

The Speaker soil is moderately deep and well drained. It formed in colluvium derived dominantly from metamorphic rock. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is dark brown loam about 13 inches thick. The upper 10 inches of the subsoil also is dark brown loam. The lower 12 inches is brown gravelly clay loam. Weathered bedrock is at a depth of about 35 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is gravelly loam.

Permeability is moderately slow in the Speaker soil. Available water capacity is about 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir. Other species that grow on this unit include ponderosa pine, incense cedar, and golden chinkapin. The understory vegetation includes creambush oceanspray, cascade Oregongrape, and deerfoot vanillaleaf.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 130 on the Josephine soil. The yield at culmination of the mean annual increment is 7,740 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 58,520 board feet per acre (Scribner rule) at 110 years. On the basis of a 50-year curve, the mean site index is 95.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 120 on the Speaker soil. The yield at culmination of the mean annual increment is 6,900 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 52,440 board feet per acre (Scribner rule) at 120 years. On the basis of a 50-year curve, the mean site index is 90.

The main limitations affecting timber production are erosion, compaction, and plant competition. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. Using standard wheeled and tracked equipment when the soils are moist causes rutting and compaction. Puddling can occur when the soils are wet. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The vegetative site is Douglas Fir-Chinkapin Forest.

92F—Josephine-Speaker complex, 35 to 55 percent north slopes. This map unit is on hillslopes. Elevation is 1,200 to 4,000 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 55 percent Josephine soil and 30 percent Speaker soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Dubakella, Goolaway, Pearsoll, and Siskiyou soils; Pollard soils on the less sloping parts of the landscape and on concave slopes; Beekman and McMullin soils on the more sloping parts of the landscape; poorly drained soils near drainageways and on concave slopes; and soils that are similar to the Josephine and Speaker soils but have more than 35 percent rock fragments. Also included are small areas of Josephine and Speaker soils that have slopes of less than 35 or more than 55 percent. Included areas make up about 15 percent of the total acreage.

The Josephine soil is deep and well drained. It formed in colluvium and residuum derived dominantly from metamorphic rock. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is dark reddish brown gravelly loam about 15 inches thick. The subsoil is dark reddish brown and reddish brown gravelly clay loam about 40 inches thick. Weathered bedrock is at a depth of about 55 inches. The depth to bedrock ranges from 40 to 60 inches. In some areas the surface layer is clay loam.

Permeability is moderately slow in the Josephine soil. Available water capacity is about 7 inches. The effective rooting depth is 40 to 60 inches. Runoff is rapid, and the hazard of water erosion is high.

The Speaker soil is moderately deep and well drained. It formed in colluvium derived dominantly from metamorphic rock. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is dark brown loam about 13 inches thick. The upper 10 inches of the subsoil also is dark brown loam. The lower 12 inches is brown gravelly clay loam. Weathered bedrock is at a depth of about 35 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is gravelly loam.

Permeability is moderately slow in the Speaker soil. Available water capacity is about 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir. Other species that grow on this unit include ponderosa pine, incense cedar, and golden chinkapin. The understory vegetation includes creambush oceanspray, cascade Oregongrape, and deerfoot vanillaleaf.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 130 on the Josephine soil. The yield at culmination of the mean annual increment is 7,740 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 58,520 board feet per acre (Scribner rule) at 110 years. On the basis of a 50-year curve, the mean site index is 95.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 120 on the Speaker soil. The yield at culmination of the mean annual increment is 6,900 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 52,440 board feet per acre (Scribner rule) at 120 years. On the basis of a 50-year curve, the mean site index is 90.

The main limitations affecting timber production are the slope, erosion, compaction, and plant competition. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. Using standard wheeled and tracked equipment when the soils are moist causes rutting and compaction. Puddling can occur when the soils are wet. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soils are saturated.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The vegetative site is Douglas Fir-Chinkapin Forest.

93E—Josephine-Speaker complex, 12 to 35 percent south slopes. This map unit is on hillslopes. Elevation is 1,200 to 4,000 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 45 percent Josephine soil and 35 percent Speaker soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Dubakella, Goolaway, and Wolfpeak soils; Abegg soils on alluvial fans and near drainageways; Pollard soils on concave slopes; Beekman soils on the more sloping parts of the landscape and on convex slopes; poorly drained soils near drainageways and on concave slopes; and soils that are similar to the Josephine and Speaker soils but have more than 35 percent rock fragments. Also included are small areas of Josephine and Speaker soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 20 percent of the total acreage.

The Josephine soil is deep and well drained. It formed in colluvium and residuum derived dominantly from metamorphic rock. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is dark reddish brown gravelly loam about 15 inches thick. The subsoil is dark reddish brown and reddish brown gravelly clay loam about 40 inches thick. Weathered bedrock is at a depth of about 55 inches. The depth to bedrock ranges from 40 to 60 inches. In some areas the surface layer is clay loam.

Permeability is moderately slow in the Josephine soil. Available water capacity is about 7 inches. The effective rooting depth is 40 to 60 inches. Runoff is medium, and the hazard of water erosion is moderate.

The Speaker soil is moderately deep and well drained. It formed in colluvium derived dominantly from metamorphic rock. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is dark brown loam about 13 inches thick. The upper 10 inches of the subsoil also is dark brown loam. The lower 12 inches is brown gravelly clay loam. Weathered bedrock is at a depth of about 35 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is gravelly loam.

Permeability is moderately slow in the Speaker soil. Available water capacity is about 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include sugar pine and California black oak. The understory vegetation includes canyon live oak, deerbrush, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 120 on the Josephine soil. The yield at culmination of the mean annual increment is 6,900 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 52,440 board feet per acre (Scribner rule) at 120 years. On the basis of a 50-year curve, the mean site index is 90.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 115 on the Josephine soil. The yield at culmination of the mean annual increment is 5,280 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 56,870 board feet per acre (Scribner rule) at 110 years.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 115 on the Speaker soil. The yield at culmination of the mean annual increment is 6,360 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 50,700 board feet per acre (Scribner rule) at 130 years. On the basis of a 50-year curve, the mean site index is 85.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 105 on the Speaker soil. The yield at culmination of the mean annual increment is 4,480 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 50,040 board feet per acre (Scribner rule) at 120 years.

The main limitations affecting timber production are erosion, compaction, seedling mortality, and plant competition. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. Using standard wheeled and tracked equipment when the soils are moist causes rutting and compaction. Puddling can occur when the soils are wet. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced by providing artificial shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The vegetative site is Douglas Fir-Black Oak Forest.

94G—Kanid-Atring very gravelly loams, 50 to 80 percent north slopes. This map unit is on hillslopes. Elevation is 2,400 to 4,100 feet. The mean annual precipitation is 45 to 60 inches, the mean annual temperature is 47 to 50 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

This unit is about 60 percent Kanid soil and 20 percent Atring soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Dubakella, Gravecreek, Norling, Pearsoll, and Steinmetz soils; Rock outcrop; Acker soils on the less sloping parts of the landscape; and, on ridges and convex slopes, soils that are similar to the Atring soil but have bedrock within a depth of 20 inches. Also included are small areas of Kanid and Atring soils that have slopes of less than 50 or more than 80 percent. Included areas make up about 20 percent of the total acreage.

The Kanid soil is deep and well drained. It formed in colluvium derived dominantly from metamorphic rock. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is dark brown and brown very gravelly loam about 18 inches thick. The subsoil is yellowish brown and light olive brown very gravelly clay loam about 29 inches thick. Weathered bedrock is at a depth of about 47 inches. The depth to bedrock ranges from 40 to 60 inches. In some areas the surface layer is stony.

Permeability is moderately rapid in the Kanid soil. Available water capacity is about 4 inches. The effective rooting depth is 40 to 60 inches. Runoff is rapid, and the hazard of water erosion is high.

The Atring soil is moderately deep and well drained. It formed in colluvium derived dominantly from metamorphic rock. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is very dark brown very gravelly loam about 7 inches thick. The subsoil is brown and yellowish brown very gravelly loam about 33 inches thick. Weathered bedrock is at a depth of about 40 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Permeability is moderately rapid in the Atring soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir. Other species that grow on this unit include incense cedar, golden chinkapin, and western hemlock. The understory vegetation includes salal, cascade Oregongrape, and deerfoot vanillaleaf.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 130 on both the Kanid and Atring soils. The yield at culmination of the mean annual increment is 7,800 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 58,520 board feet per acre (Scribner rule) at 110 years. On the basis of a 50-year curve, the mean site index is 95.

The main limitations affecting timber production are the slope, erosion, plant competition, and seedling mortality. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

The slope restricts the use of wheeled and tracked logging equipment. High-lead or other cable systems are the best methods of logging. If the soils are excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Ripping landings when the soils are dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Road cuts can expose a large amount of fractured bedrock, which limits the response to seeding and mulching. Cut slopes are subject to slumping where the bedrock is highly fractured or where rock layers are parallel to the slopes. Steep yarding paths and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both.

Building logging roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. The large number of rock fragments in the soils also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings.

Increased erosion, loss of plant nutrients, and water repellency are likely to result from fires of moderate intensity.

The vegetative site is Mixed Fir-Salal (rhododendron) Forest.

95G—Kanid-Atring very gravelly loams, 50 to 80 percent south slopes. This map unit is on hillslopes. Elevation is 2,400 to 4,100 feet. The mean annual precipitation is 45 to 60 inches, the mean annual temperature is 47 to 50 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

This unit is about 60 percent Kanid soil and 20 percent Atring soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Dubakella, Gravecreek, Norling, Pearsoll, and Steinmetz soils; Rock outcrop; Acker soils on the less sloping parts of the landscape; and, on ridges and convex slopes, soils that are similar to the Atring soil but have bedrock within a depth of 20 inches. Also included are small areas of Kanid and Atring soils that have slopes of less than 50 or more than 80 percent. Included areas make up about 20 percent of the total acreage.

The Kanid soil is deep and well drained. It formed in colluvium derived dominantly from metamorphic rock. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is dark brown and brown very gravelly loam about 18 inches thick. The subsoil is yellowish brown and light olive brown very gravelly clay loam about 29 inches thick. Weathered bedrock is at a depth of about 47 inches. The depth to bedrock ranges from 40 to 60 inches. In some areas the surface layer is stony.

Permeability is moderately rapid in the Kanid soil. Available water capacity is about 4 inches. The effective rooting depth is 40 to 60 inches. Runoff is rapid, and the hazard of water erosion is high.

The Atring soil is moderately deep and well drained. It formed in colluvium derived dominantly from metamorphic rock. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is very dark brown very gravelly loam about 7 inches thick. The subsoil is brown and yellowish brown very gravelly loam about 33 inches thick. Weathered bedrock is at a depth of about 40 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Permeability is moderately rapid in the Atring soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir. Other species that grow on this unit include incense cedar, golden chinkapin, and Pacific madrone. The understory vegetation includes Whipplevine, cascade Oregongrape, and deerfoot vanillaleaf.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 120 on both the Kanid and Atring soils. The yield at culmination of the mean annual increment is 6,900 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 52,440 board feet per acre (Scribner rule) at 120 years. On the basis of a 50-year curve, the mean site index is 90.

The main limitations affecting timber production are the slope, erosion, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

The slope restricts the use of wheeled and tracked logging equipment. High-lead or other cable systems are the best methods of logging. If the soils are excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Ripping landings when the soils are dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Road cuts can expose a large amount of fractured bedrock, which limits the response to seeding and mulching. Cut slopes are subject to slumping where the bedrock is highly fractured or where rock layers are parallel to the slopes. Steep yarding paths and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both.

Building logging roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced by providing artificial shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

Increased erosion, loss of plant nutrients, and water repellency are likely to result from fires of moderate intensity.

The vegetative site is Douglas Fir-Madrone-Chinkapin Forest.

96B—Kanutchan clay, 1 to 8 percent slopes. This deep, somewhat poorly drained soil is in basins. It formed in alluvium and colluvium derived dominantly from andesite, tuff, and breccia. Elevation is 3,600 to 5,500 feet. The mean annual precipitation is 25 to 50 inches, the mean annual temperature is 40 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly grasses, sedges, and forbs.

Typically, the surface layer is black clay about 20 inches thick. The subsoil is black and very dark gray clay about 26 inches thick. Bedrock is at a depth of about 46 inches. The depth to bedrock ranges from 40 to 60 inches. In some areas the surface layer is cobbly or stony.

Included in this unit are small areas of Bybee, Farva, Pinehurst, Sibannac, and Tatouche soils. Also included are small areas of soils that are similar to the Kanutchan soil but have bedrock at a depth of less than 40 or more than 60 inches and small areas of Kanutchan soils that have slopes of more than 8 percent. Included areas make up about 15 percent of the total acreage.

Permeability is very slow in the Kanutchan soil. Available water capacity is about 7 inches. The effective rooting depth is limited by the water table, which is within a depth of 1.5 feet from December through May. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for livestock grazing and wildlife habitat. It is well suited to permanent pasture. The main limitations affecting livestock grazing are the seasonal wetness, compaction, the high content of clay, and a slow rate of water intake. The wetness limits the choice of suitable forage plants and the period of cutting or grazing and increases the risk of winterkill. The high content of clay severely limits tillage and root growth. Deep cracks form as the soil dries in summer.

If the pasture is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. The grazing system should maintain the desired balance of species in the plant community. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth.

Tufted hairgrass is the native plant preferred for livestock grazing; however, this unit can be renovated and forage production increased by seeding other suitable grasses. The plants selected for seeding should be those that are tolerant of wetness. Border and contour flood irrigation systems are suitable. Because of the very slow permeability, water applications should be regulated so that the water does not stand on the surface and damage the crop. Land leveling helps to ensure a uniform application of water. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

The vegetative site is Wet Meadow.

97A—Kerby loam, 0 to 3 percent slopes. This very deep, well drained soil is on stream terraces. It formed in alluvium derived from mixed sources. Elevation is 1,000 to 2,000 feet. The mean annual precipitation is 18 to 35 inches, the mean annual temperature is 50 to 54 degrees F, and the average frost-free period is 140 to 180 days. The vegetation in areas that have not been cultivated is mainly grasses and forbs.

Typically, the surface layer is very dark grayish brown loam about 7 inches thick. The subsoil is dark brown loam about 47 inches thick. The substratum to a depth of 60 inches is dark brown very gravelly sandy loam.

Included in this unit are small areas of Gregory and Kubli soils on concave slopes, Central Point and Medford soils, and soils that are similar to the Kerby soil but have very gravelly layers within a depth of 40 inches. Also included are small areas of Kerby soils that have slopes of more than 3 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately slow in the Kerby soil. Available water capacity is about 10 inches. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used mainly for irrigated crops, such as grass seed, onions, alfalfa, and tree fruit. Other crops include strawberries, small grain, and sugar beet seed. Some areas are used for homesite development or pasture.

This unit is well suited to irrigated crops. It has few limitations. In summer, irrigation is needed for the maximum production of most crops. Furrow, border, corrugation, trickle, and sprinkler irrigation systems are suitable. The system used generally is governed by the crop that is grown. For the efficient application and removal of surface irrigation water, land leveling is needed. To prevent overirrigation and the leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. The use of pipe, ditch lining, or drop structures in irrigation ditches reduces water loss and the hazard of erosion.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Leaving crop residue on or near the surface helps to conserve moisture and control erosion.

A tillage pan forms easily if the soil is tilled when wet. Chiseling or subsoiling breaks up the pan. Surface crusting and compaction can be minimized by returning crop residue to the soil.

Solid-set sprinkler irrigation is the best method of controlling frost and providing adequate moisture for tree fruit. Compaction can be minimized by limiting the use of equipment when the soil is wet. A permanent cover crop helps to control runoff and erosion.

Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

This unit is well suited to homesite development. It has few limitations. Cutbanks are not stable and are subject to slumping. To keep cutbanks from caving in, excavations may require special retainer walls. Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

The vegetative site is Deep Loamy Terrace, 18- to 28-inch precipitation zone.

98A—Kerby loam, wet, 0 to 3 percent slopes. This very deep, moderately well drained soil is on stream terraces. It formed in alluvium derived from mixed sources. Elevation is 1,000 to 1,500 feet. The mean annual precipitation is 18 to 35 inches, the mean annual temperature is 50 to 54 degrees F, and the average frost-free period is 140 to 180 days. The vegetation in areas that have not been cultivated is mainly hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is dark brown and dark yellowish brown loam about 15 inches thick. The subsoil is brown and dark yellowish brown clay loam about 40 inches thick. The substratum to a depth of 60 inches is dark yellowish brown loam. The depth to bedrock is 60 inches or more.

Included in this unit are small areas of Central Point, Kerby, and Medford soils; Gregory soils on concave slopes; and Brader, Debenger, and Langellain soils on convex slopes. Also included are small areas of Kerby soils that have slopes of more than 3 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderately slow in the Kerby soil. Available water capacity is about 10 inches. The effective rooting depth is limited by the water table, which is at a depth of 1.5 to 2.5 feet from December through May. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for irrigated small grain and hay and pasture.

This unit is suited to irrigated crops. It is limited mainly by wetness in winter and spring. Crops that require good drainage can be grown if a properly designed tile drainage system is installed. Tile drainage can lower the water table if a suitable outlet is available. Land smoothing and open ditches can reduce surface wetness.

In summer, irrigation is needed for the maximum production of most crops. Furrow, border, corrugation, trickle, and sprinkler irrigation systems are suitable. The system used generally is governed by the crop that is grown. For the efficient application and removal of surface irrigation water, land leveling is needed. To prevent overirrigation and excessive erosion, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. The use of pipe, ditch lining, or drop structures in irrigation ditches reduces water loss and the hazard of erosion.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Leaving crop residue on or near the surface helps to conserve moisture and control erosion.

A tillage pan forms easily if the soil is tilled when wet. Chiseling or subsoiling breaks up the pan. Surface crusting and compaction can be minimized by returning crop residue to the soil.

The main limitations in the areas used for hay and pasture are wetness in winter and spring and compaction. The wetness limits the choice of suitable forage plants and the period of cutting or grazing and increases the risk of winterkill. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

The vegetative site is Loamy Hills, 20- to 35-inch precipitation zone.

99A—Klamath silt loam, 0 to 1 percent slopes. This very deep, poorly drained soil is on flood plains. It formed in alluvium derived dominantly from volcanic ash, andesite, and basalt. Elevation is 3,900 to 5,400 feet. The mean annual precipitation is 25 to 35 inches, the mean annual temperature is 42 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly grasses, sedges, and forbs.

Typically, the surface layer is black silt loam about 3 inches thick. The next layer is black clay about 8 inches thick. The subsoil is very dark gray and dark gray silty clay about 26 inches thick. The substratum to a depth of 62 inches is gray silty clay loam and clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is gravelly or cobbly.

Included in this unit are small areas of Pokegema and Woodcock soils; very stony, shallow soils; and very poorly drained, organic soils. Also included are small areas of soils that are similar to the Klamath soil but are well drained or are not flooded and small areas of Klamath soils that have slopes of more than 1 percent. Included areas make up about 10 percent of the total acreage.

Permeability is slow in the Klamath soil. Available water capacity is about 13 inches. The effective rooting depth is limited by the water table, which is within a depth of 3 feet from March through June. Runoff is slow, and the hazard of water erosion is slight. This soil is frequently flooded for long periods from March through May.

This unit is used for livestock grazing and wildlife habitat. It is suited to pasture. The main limitations affecting livestock grazing are the flooding, the seasonal wetness, compaction, and a short growing season. The wetness limits the choice of suitable forage plants and the period of grazing and increases the risk of winterkill.

If the pasture is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. The grazing system should maintain the desired balance of species in the plant community. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

Tufted hairgrass is the native plant preferred for livestock grazing; however, this unit can be renovated and forage production increased by seeding other suitable grasses. The plants selected for seeding should be those that are tolerant of wetness.

The vegetative site is Wet Meadow.

100A—Kubli loam, 0 to 3 percent slopes. This very deep, somewhat poorly drained soil is on stream terraces. It formed in alluvium derived dominantly from granitic rock and underlain by clayey sediment. Elevation is 1,000 to 2,300 feet. The mean annual precipitation is 18 to 30 inches, the mean annual temperature is 50 to 54 degrees F, and the average frost-free period is 150 to 180 days. The vegetation in areas that have not been cultivated is mainly grasses and forbs.

Typically, the surface layer is very dark brown loam about 9 inches thick. The next layer is very dark grayish brown loam about 6 inches thick. The subsoil is dark grayish brown loam about 16 inches thick. The upper 16 inches of the substratum is brown clay. The lower part to a depth of 60 inches is brown clay loam.

Included in this unit are small areas of Medford soils, Barron and Central Point soils on the higher terraces and alluvial fans, and Gregory soils and poorly drained or very poorly drained, loamy soils near drainageways and on concave slopes. Also included are small areas of Kubli soils that have slopes of more than 3 percent. Included areas make up about 10 percent of the total acreage.

Permeability is moderate to a depth of 31 inches in the Kubli soil and very slow below that depth. Available water capacity is about 10 inches. The effective rooting depth is limited by the dense, clayey substratum, which is at a depth of 25 to 35 inches. Runoff is slow, and the hazard of water erosion is slight. The water table, which is perched above the layer of clay, is at a depth of 0.5 foot to 3.0 feet from November through April.

This unit is used mainly for homesite development, pasture, or irrigated crops, such as alfalfa hay, small grain, and grass-legume hay. It also is used for tree fruit, sugar beet seed, and corn for silage.

This unit is suited to irrigated crops. It is limited mainly by wetness in winter and spring and the very slow permeability. Crops that require good drainage can be grown if a properly designed tile drainage system is installed. Tile drainage can lower the water table if collection laterals are closely spaced and a suitable outlet is available. Land smoothing and open ditches can reduce the surface wetness.

In summer, irrigation is needed for the maximum production of most crops. Furrow, border, corrugation, trickle, and sprinkler irrigation systems are suitable. The system used generally is governed by the crop that is grown. For the efficient application and removal of surface irrigation water, land leveling is needed. To prevent overirrigation and the development of a perched water table, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. The use of pipe, ditch lining, or drop structures in irrigation ditches reduces water loss and the hazard of erosion.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Leaving crop residue on or near the surface helps to conserve moisture and control erosion.

A tillage pan forms easily if the soil is tilled when wet. Chiseling or subsoiling breaks up the pan. Surface crusting and compaction can be minimized by returning crop residue to the soil.

Solid-set sprinkler irrigation is the best method of controlling frost and providing adequate moisture for tree fruit. Compaction can be minimized by limiting the use of equipment when the soil is wet. A permanent cover crop helps to control runoff and erosion.

Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

The main limitations affecting homesite development are the wetness, the very slow permeability in the substratum, a high shrink-swell potential, and low strength.

The very slow permeability and the perched water table increase the possibility that septic tank absorption fields will fail. Interceptor ditches can divert subsurface water and thus improve the efficiency of the absorption fields. Alternative waste disposal systems may function properly on this unit. Suitable included soils are throughout the unit. Onsite investigation is needed to locate such soils.

Because the seasonal high water table is perched above the layer of clay, a drainage system is needed if buildings with basements and crawl spaces are constructed on this unit. The wetness can be reduced by installing drainage tile around footings. Properly designing foundations and footings, diverting runoff away from the buildings, and backfilling with material that has a low shrink-swell potential help to prevent the structural damage caused by shrinking and swelling. Properly designing buildings and roads helps to offset the limited ability of the soil to support a load.

Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. In many areas it may be necessary to haul in topsoil for lawns and gardens. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

The vegetative site is Deep Loamy Terrace, 18- to 28-inch precipitation zone.

100B—Kubli loam, 3 to 7 percent slopes. This very deep, somewhat poorly drained soil is on terraces. It formed in alluvium derived dominantly from granitic rock and underlain by clayey sediment. Elevation is 1,000 to 2,300 feet. The mean annual precipitation is 18 to 30 inches, the mean annual temperature is 50 to 54 degrees F, and the average frost-free period is 150 to 180 days. The vegetation in areas that have not been cultivated is mainly grasses and forbs.

Typically, the surface layer is very dark brown loam about 9 inches thick. The next layer is very dark grayish brown loam about 6 inches thick. The subsoil is dark grayish brown loam about 16 inches thick. The upper 16 inches of the substratum is brown clay. The lower part to a depth of 60 inches is brown clay loam.

Included in this unit are small areas of Medford soils, Barron and Central Point soils on the higher terraces and alluvial fans, and Gregory soils and poorly drained or very poorly drained, loamy soils near drainageways and on concave slopes. Also included are small areas of Kubli soils that have slopes of less than 3 or more than 7 percent. Included areas make up about 10 percent of the total acreage.

Permeability is moderate to a depth of 31 inches in the Kubli soil and very slow below that depth. Available water capacity is about 10 inches. The effective rooting depth is limited by the dense, clayey substratum, which is at a depth of 25 to 35 inches. Runoff is slow, and the hazard of water erosion is slight. The water table, which is perched above the layer of clay, is at a depth of 0.5 foot to 3.0 feet from November through April.

This unit is used mainly for homesite development or for hay and pasture. It also is used for tree fruit.

This unit is suited to irrigated crops. It is limited mainly by wetness in winter and spring, the very slow permeability, and the slope. Crops that require good drainage can be grown if a properly designed tile drainage system is installed. Tile drainage can lower the water table if collection laterals are closely spaced and a suitable outlet is available. Open ditches and land smoothing on the less sloping parts of the landscape can reduce surface wetness.

In summer, irrigation is needed for the maximum production of most crops. Furrow, border, corrugation, trickle, and sprinkler irrigation systems are suitable. The system used generally is governed by the crop that is grown. For the efficient application and removal of surface irrigation water, land leveling is needed. To prevent overirrigation and the development of a perched water table, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. The use of pipe, ditch lining, or drop structures in irrigation ditches reduces water loss and the hazard of erosion.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Leaving crop residue on or near the surface helps to conserve moisture and control erosion.

A tillage pan forms easily if the soil is tilled when wet. Chiseling or subsoiling breaks up the pan. Surface crusting and compaction can be minimized by returning crop residue to the soil.

Solid-set sprinkler irrigation is the best method of controlling frost and providing adequate moisture for tree fruit. Compaction can be minimized by limiting the use of equipment when the soil is wet. A permanent cover crop helps to control runoff and erosion.

Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

The main limitations affecting homesite development are the wetness, the very slow permeability, a high shrink-swell potential, and low strength.

The very slow permeability and the seasonal high water table increase the possibility that septic tank absorption fields will fail. Interceptor ditches can divert subsurface water and thus improve the efficiency of the absorption fields. Alternative waste disposal systems may function properly on this unit. Suitable included soils are throughout the unit. Onsite investigation is needed to locate such soils.

Because the seasonal high water table is perched above the layer of clay, a drainage system is needed on sites for buildings with basements and crawl spaces. The wetness can be reduced by installing drainage tile around footings. Properly designing foundations and footings, diverting runoff away from the buildings, and backfilling with material that has a low shrink-swell potential help to prevent the structural damage caused by shrinking and swelling. Properly designing buildings and roads helps to offset the limited ability of the soil to support a load.

Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. In many areas it may be necessary to haul in topsoil for lawns and gardens. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

The vegetative site is Deep Loamy Terrace, 18- to 28-inch precipitation zone.

101E—Langellain loam, 15 to 40 percent north slopes. This moderately deep, moderately well drained soil is on hillslopes. It formed in colluvium and alluvium derived dominantly from sedimentary rock. Elevation is 1,300 to 3,200 feet. The mean annual precipitation is 18 to 40 inches, the mean annual temperature is 48 to 54 degrees F, and the average frost-free period is 130 to 180 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of grasses, twigs, and leaves about ½ inch thick. The surface layer is dark reddish brown loam about 6 inches thick. The next layer is dark brown loam about 4 inches thick. The upper 11 inches of the subsoil is strong brown loam. The lower 17 inches is brown and yellowish brown clay. Weathered bedrock is at a depth of about 38 inches. The depth to bedrock ranges from 20 to 40 inches.

Included in this unit are small areas of Debenger soils, Carney and Selmac soils on concave slopes, Brader soils on ridges and convex slopes, Ruch and Manita soils on foot slopes, and soils that are similar to the Langellain soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Langellain soils that have slopes of less than 15 or more than 40 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderate to a depth of 21 inches in the Langellain soil and very slow below that depth. Available water capacity is about 4 inches. The effective rooting depth is limited by the layer of dense clay in the subsoil. This layer is at a depth of 12 to 28 inches. Runoff is medium or rapid, and the hazard of water erosion is moderate or high. The water table, which is perched above the layer of clay, is at a depth of 0.5 foot to 2.0 feet from December through May.

This unit is used for livestock grazing, timber production, and wildlife habitat.

The main limitations affecting livestock grazing are compaction, erosion, and seasonal wetness. The vegetation suitable for grazing includes western fescue, mountain brome, and tall trisetum. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Because this soil remains wet for long periods in spring, grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

This unit is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include incense cedar and Pacific madrone. The understory vegetation includes oceanspray, tall Oregon grape, and poison oak.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 90. The yield at culmination of the mean annual increment is 4,200 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 31,840 board feet per acre (Scribner rule) at 160 years. On the basis of a 50-year curve, the mean site index is 65.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 90. The yield at culmination of the mean annual increment is 3,400 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 37,960 board feet per acre (Scribner rule) at 130 years.

The main limitations affecting timber production are erosion, compaction, slumping, the seasonal wetness, plant competition, and seedling mortality. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

The perched seasonal high water table limits the use of equipment to dry periods. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both.

This unit is subject to severe slumping. Road failure and landslides are likely to occur after road construction. Slumping can be minimized by constructing logging roads in the less sloping areas, on better suited soils if practical, and by installing properly designed road drainage systems. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting ponderosa pine seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seasonal wetness increases the seedling mortality rate. Also, seedlings planted in the less fertile clayey subsoil grow poorly.

The vegetative site is Douglas Fir Forest.

102B—Langellain-Brader loams, 1 to 7 percent slopes. This map unit is on knolls and ridges. Elevation is 1,300 to 3,200 feet. The mean annual precipitation is 18 to 40 inches, the mean annual temperature is 48 to 54 degrees F, and the average frost-free period is 130 to 180 days. The native vegetation is mainly hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 55 percent Langellain soil and 20 percent Brader soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Debenger and Ruch soils, Carney and Selmac soils on concave slopes, Coker and Gregory soils on concave slopes and near drainageways, Kerby and Medford soils on terraces, and soils that are similar to the Brader soil but have bedrock within a depth of 12 inches. Also included are small areas of Langellain and Brader soils that have slopes of more than 7 percent. Included areas make up about 25 percent of the total acreage.

The Langellain soil is moderately deep and moderately well drained. It formed in colluvium and alluvium derived dominantly from sedimentary rock. Typically, the surface is covered with a layer of grasses, twigs, and leaves about ½ inch thick. The surface layer is dark reddish brown loam about 6 inches thick. The next layer is dark brown loam about 4 inches thick. The upper 11 inches of the subsoil is strong brown loam. The lower 17 inches is brown and yellowish brown clay. Weathered bedrock is at a depth of about 38 inches. The depth to bedrock ranges from 20 to 40 inches.

Permeability is moderate to a depth of 21 inches in the Langellain soil and very slow below that depth. Available water capacity is about 4 inches. The effective rooting depth is limited by the layer of dense clay in the subsoil. This layer is at a depth of 12 to 28 inches. Runoff is slow, and the hazard of water erosion is slight. The water table, which is perched above the layer of clay, is at a depth of 0.5 foot to 2.0 feet from December through May.

The Brader soil is shallow and well drained. It formed in colluvium derived dominantly from sedimentary rock. Typically, the surface layer is dark brown loam about 6 inches thick. The subsoil is dark reddish brown loam about 7 inches thick. Weathered bedrock is at a depth of about 13 inches. The depth to bedrock ranges from 12 to 20 inches.

Permeability is moderate in the Brader soil. Available water capacity is about 2 inches. The effective rooting depth is 12 to 20 inches. Runoff is slow or medium, and the hazard of water erosion is slight or moderate.

This unit is used for hay and pasture, livestock grazing, and homesite development.

This unit is suited to irrigated hay and pasture. It is limited mainly by droughtiness; the depth to bedrock in the Brader soil; and, in the Langellain soil, the very slow permeability in the subsoil and wetness in winter and spring.

In summer, irrigation is needed for the maximum production of hay and pasture. Sprinkler irrigation is the best method of applying water. This method permits an even, controlled application of water, helps to prevent excessive runoff, and minimizes the risk of erosion. Border and contour flood irrigation systems also are suitable in the less sloping areas. For the efficient application and removal of surface irrigation water, land leveling is needed. If cuts are too deep, however, the bedrock or the clayey subsoil may be exposed. To prevent overirrigation and excessive erosion or development of a perched water table, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop.

Wetness limits the choice of suitable forage plants and the period of cutting or grazing and increases the risk of winterkill. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soils from erosion. Grazing when the soils are wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth.

The ability of tile drains to remove subsurface water is limited because of the very slow permeability in the subsoil of the Langellain soil and the lack of suitable outlets. Land smoothing and open ditches can reduce surface wetness.

Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

The main limitations affecting livestock grazing are compaction and droughtiness. The Langellain soil also is limited by wetness in winter and spring and the Brader soil by the depth to bedrock. The vegetation suitable for grazing includes Idaho fescue, bluebunch wheatgrass, and pine bluegrass. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

The Langellain soil remains wet for long periods in spring; therefore, grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock. Compaction can be minimized by grazing first in the areas that dry out earliest.

Range seeding is suitable if the site is in poor condition. The main limitations affecting seeding are the wetness of the Langellain soil in winter and spring, the depth to bedrock in the Brader soil, and droughtiness in both soils. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the depth to bedrock.

The main limitations affecting homesite development are the wetness, a high shrink-swell potential, the very slow permeability, and the depth to bedrock.

This unit is poorly suited to standard systems of waste disposal because of the wetness, the very slow permeability, and the depth to bedrock. Alternative waste disposal systems may function properly on this unit. Suitable included soils are throughout the unit. Onsite investigation is needed to locate such soils.

Because the seasonal high water table is perched above the layer of clay, a drainage system is needed on sites for buildings with basements and crawl spaces. The wetness can be reduced by installing drainage tile around footings. If buildings are constructed on the Langellain soil, properly designing foundations and footings, diverting runoff away from the buildings, and backfilling with material that has a low shrink-swell potential help to prevent the structural damage caused by shrinking and swelling. Properly designing buildings and roads helps to offset the limited ability of the Langellain soil to support a load.

Cuts needed to provide essentially level building sites can expose bedrock. Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

The vegetative site is Loamy Hills, 20- to 35-inch precipitation zone.

102D—Langellain-Brader loams, 7 to 15 percent slopes. This map unit is on knolls and ridges. Elevation is 1,300 to 3,200 feet. The mean annual precipitation is 18 to 40 inches, the mean annual temperature is 48 to 54 degrees F, and the average frost-free period is 130 to 180 days. The native vegetation is mainly hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 55 percent Langellain soil and 25 percent Brader soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Carney and Selmac soils on concave slopes, Coker and Gregory soils near drainageways, Medford soils on terraces, Debenger and Ruch soils, and soils that are similar to the Brader soil but have bedrock within a depth of 12 inches. Also included are small areas of Langellain and Brader soils that have slopes of less than 7 or more than 15 percent. Included areas make up about 20 percent of the total acreage.

The Langellain soil is moderately deep and moderately well drained. It formed in colluvium and alluvium derived dominantly from sedimentary rock. Typically, the surface is covered with a layer of grasses, twigs, and leaves about ½ inch thick. The surface layer is dark reddish brown loam about 6 inches thick. The next layer is dark brown loam about 4 inches thick. The upper 11 inches of the subsoil is strong brown loam. The lower 17 inches is brown and yellowish brown clay. Weathered bedrock is at a depth of about 38 inches. The depth to bedrock ranges from 20 to 40 inches.

Permeability is moderate to a depth of 21 inches in the Langellain soil and very slow below that depth. Available water capacity is about 4 inches. The effective rooting depth is limited by the layer of dense clay in the subsoil. This layer is at a depth of 12 to 28 inches. Runoff is medium, and the hazard of water erosion is moderate. The water table, which is perched above the layer of clay, is at a depth of 0.5 foot to 2.0 feet from December through May.

The Brader soil is shallow and well drained. It formed in colluvium derived dominantly from sedimentary rock. Typically, the surface layer is dark brown loam about 6 inches thick. The subsoil is dark reddish brown loam about 7 inches thick. Weathered bedrock is at a depth of about 13 inches. The depth to bedrock ranges from 12 to 20 inches.

Permeability is moderate in the Brader soil. Available water capacity is about 2 inches. The effective rooting depth is 12 to 20 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for hay and pasture, livestock grazing, and homesite development.

This unit is suited to irrigated hay and pasture. It is limited mainly by droughtiness, the slope, and the depth to bedrock in the Brader soil. The Langellain soil also is limited by the very slow permeability in the subsoil and wetness in winter and spring.

In summer, irrigation is needed for the maximum production of hay and pasture. Sprinkler irrigation is the best method of applying water. This method permits an even, controlled application of water, helps to prevent excessive runoff, and minimizes the risk of erosion. To prevent overirrigation and excessive erosion or development of a perched water table, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop.

Wetness limits the choice of suitable forage plants and the period of cutting or grazing and increases the risk of winterkill. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soils from erosion. Grazing when the soils are wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth.

The ability of tile drains to remove subsurface water is limited because of the slope, the very slow permeability in the subsoil of the Langellain soil, and the lack of suitable outlets. Wetness can be reduced by interceptor drains.

Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

The main limitations affecting livestock grazing are compaction, erosion, and droughtiness. The Langellain soil also is limited by wetness in winter and spring and the Brader soil by the depth to bedrock. The vegetation suitable for grazing includes Idaho fescue, bluebunch wheatgrass, and pine bluegrass. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

The Langellain soil remains wet for long periods in spring. As a result, grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock. Compaction can be minimized by grazing first in the areas that dry out earliest.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment.

Range seeding is suitable if the site is in poor condition. The main limitations are the wetness of the Langellain soil in winter and spring, the depth to bedrock in the Brader soil, and droughtiness in both soils. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the depth to bedrock.

The main limitations affecting homesite development are the wetness, a high shrink-swell potential, the depth to bedrock, and the very slow permeability in the Langellain soil.

This unit is poorly suited to standard systems of waste disposal because of the wetness, the very slow permeability, and the depth to bedrock. Alternative waste disposal systems may function properly on this unit. Suitable included soils are throughout the unit. Onsite investigation is needed to locate such soils.

Because the seasonal high water table is perched above the layer of clay, a drainage system is needed on sites for buildings with basements and crawl spaces. The wetness can be reduced by installing drainage tile around footings. If buildings are constructed on the Langellain soil, properly designing foundations and footings, diverting runoff away from the buildings, and backfilling with material that has a low shrink-swell potential help to prevent the structural damage caused by shrinking and swelling. Properly designing buildings and roads helps to offset the limited ability of the Langellain soil to support a load.

Cuts needed to provide essentially level building sites can expose bedrock. Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. In many areas it may be necessary to haul in topsoil for lawns and gardens. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

The vegetative site is Loamy Hills, 20- to 35-inch precipitation zone.

103E—Langellain-Brader loams, 15 to 40 percent south slopes. This map unit is on hillslopes. Elevation is 1,300 to 3,200 feet. The mean annual precipitation is 18 to 40 inches, the mean annual temperature is 48 to 54 degrees F, and the average frost-free period is 130 to 180 days. The native vegetation is mainly hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 50 percent Langellain soil and 30 percent Brader soil. The components of this unit occur as areas so intricately intermingled that mapping them

separately was not practical at the scale used.

Included in this unit are small areas of Debenger soils, Carney and Selmac soils on concave slopes, Ruch and Manita soils on foot slopes, and soils that are similar to the Brader soil but have more than 35 percent rock fragments or have bedrock within a depth of 12 inches. Also included are small areas of Langellain and Brader soils that have slopes of less than 15 or more than 40 percent. Included areas make up about 20 percent of the total acreage.

The Langellain soil is moderately deep and moderately well drained. It formed in colluvium and alluvium derived dominantly from sedimentary rock. Typically, the surface is covered with a layer of grasses, twigs, and leaves about ½ inch thick. The surface layer is dark reddish brown loam about 6 inches thick. The next layer is dark brown loam about 4 inches thick. The upper 11 inches of the subsoil is strong brown loam. The lower 17 inches is brown and yellowish brown clay. Weathered bedrock is at a depth of about 38 inches. The depth to bedrock ranges from 20 to 40 inches.

Permeability is moderate to a depth of 21 inches in the Langellain soil and very slow below that depth. Available water capacity is about 4 inches. The effective rooting depth is limited by the layer of dense clay in the subsoil. This layer is at a depth of 12 to 28 inches. Runoff is medium or rapid, and the hazard of water erosion is moderate or high. The water table, which is perched above the layer of clay, is at a depth of 0.5 foot to 2.0 feet from December through May.

The Brader soil is shallow and well drained. It formed in colluvium derived dominantly from sandstone. Typically, the surface layer is dark brown loam about 6 inches thick. The subsoil is dark reddish brown loam about 7 inches thick. Weathered bedrock is at a depth of about 13 inches. The depth to bedrock ranges from 12 to 20 inches.

Permeability is moderate in the Brader soil. Available water capacity is about 2 inches. The effective rooting depth is 12 to 20 inches. Runoff is medium or rapid, and the hazard of water erosion is moderate or high.

This unit is used for livestock grazing and wildlife habitat. The main limitations affecting livestock grazing are compaction, erosion, droughtiness, and the slope. The Langellain soil also is limited by wetness in winter and spring and the Brader soil by the depth to bedrock. The vegetation suitable for grazing includes Idaho fescue, bluebunch wheatgrass, and pine bluegrass. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

The Langellain soil remains wet for long periods in spring. As a result, grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock. Compaction can be minimized by grazing first in the areas that dry out earliest.

Range seeding is suitable if the site is in poor condition. The main limitations are the depth to bedrock in the Brader soil, the wetness of the Langellain soil in winter and spring, and droughtiness and the slope in areas of both soils. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment. In places the use of ground equipment and access by livestock are limited by the slope. Constructing trails or walkways allows livestock to graze in areas where access is limited.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the slope and the depth to bedrock.

The vegetative site is Loamy Hills, 20- to 35-inch precipitation zone.

104E—Lettia sandy loam, 12 to 35 percent north slopes. This deep, well drained soil is on hillslopes. It formed in colluvium and residuum derived from granitic rock. Elevation is 1,800 to 4,000 feet. The mean annual precipitation is 45 to 60 inches, the mean annual temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about 2 inches thick. The surface layer is dark brown sandy loam about 3 inches thick. The next layer is brown and reddish brown loam about 11 inches thick. The upper 12 inches of the subsoil is red clay loam. The lower 29 inches is red loam. Weathered bedrock is at a depth of about 55 inches. The depth to bedrock ranges from 40 to 60 inches. In some areas the surface layer is clay loam.

Included in this unit are small areas of Acker, Dumont, Goolaway, and Musty soils; Steinmetz soils on the more sloping parts of the landscape; poorly drained soils near drainageways and on concave slopes; soils that are similar to the Lettia soil but have bedrock at a depth of more than 60 inches; and, on ridges and convex slopes, soils that are similar to Steinmetz and Lettia soils but have bedrock within a depth of 40 inches. Also included are small areas of Lettia soils that have slopes of less than 12 or more than 35 percent.

Included areas make up about 20 percent of the total acreage.

Permeability is moderately slow in the Lettia soil. Available water capacity is about 8 inches. The effective rooting depth is 40 to 60 inches. Runoff is medium, and the hazard of water erosion is moderate or high.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir. Other species that grow on this unit include incense cedar, western hemlock, and Pacific madrone. The understory vegetation includes golden chinkapin, salal, and cascade Oregongrape.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 140. The yield at culmination of the mean annual increment is 8,700 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 48,300 board feet per acre (Scribner rule) at 140 years. On the basis of a 50-year curve, the mean site index is 105.

The main limitations affecting timber production are erosion, compaction, plant competition, and seedling mortality. When timber is harvested, management that minimizes the risk of erosion is essential. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

This unit is subject to slumping, especially in areas adjacent to drainageways. Road failure and landslides are likely to occur after road construction and clearcutting. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings.

Increased erosion, loss of plant nutrients, and water repellency are likely to result from fires of moderate intensity.

The vegetative site is Mixed Fir-Salal (rhododendron) Forest.

105E—Lettia sandy loam, 12 to 35 percent south slopes. This deep, well drained soil is on hillslopes. It formed in colluvium and residuum derived from granitic rock. Elevation is 1,800 to 4,000 feet. The mean annual precipitation is 45 to 60 inches, the mean annual temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about 2 inches thick. The surface layer is dark brown sandy loam about 3 inches thick. The next layer is brown and reddish brown loam about 11 inches thick. The upper 12 inches of the subsoil is red clay loam. The lower 29 inches is red loam. Weathered bedrock is at a depth of about 55 inches. The depth to bedrock ranges from 40 to 60 inches. In some areas the surface layer is clay loam.

Included in this unit are small areas of Acker, Dumont, Goolaway, and Musty soils; Steinmetz soils on the more sloping parts of the landscape; poorly drained soils near drainageways and on concave slopes; soils that are similar to the Lettia soil but have bedrock at a depth of more than 60 inches; and, on ridges and convex slopes, soils that are similar to the Lettia soil but have bedrock within a depth of 40 inches. Also included are small areas of Lettia soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately slow in the Lettia soil. Available water capacity is about 8 inches. The effective rooting depth is 40 to 60 inches. Runoff is medium, and the hazard of water erosion is moderate or high.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir. Other species that grow on this unit include incense cedar, sugar pine, and Pacific madrone. The understory vegetation includes golden chinkapin, Whipplevine, and cascade Oregongrape.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 130. The yield at culmination of the mean annual increment is 7,740 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 58,520 board feet per acre (Scribner rule) at 110 years. On the basis of a 50-year curve, the mean site index is 100.

The main limitations affecting timber production are erosion, compaction, seedling mortality, and plant competition. When timber is harvested, management that minimizes the risk of erosion is essential. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

This unit is subject to slumping, especially in areas adjacent to drainageways. Road failure and landslides are likely to occur after road construction and clearcutting. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

Increased erosion, loss of plant nutrients, and water repellency are likely to result from fires of moderate intensity.

The vegetative site is Douglas Fir-Madrone-Chinkapin Forest.

106C—Lobert sandy loam, 0 to 12 percent slopes. This very deep, well drained soil is on stream terraces. It formed in alluvial and lacustrine sediment derived dominantly from tuff and volcanic ash. Elevation is 4,200 to 4,400 feet. The mean annual precipitation is 16 to 18 inches, the mean annual temperature is 43 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles and twigs about 2 inches thick. The surface layer is dark reddish brown sandy loam about 20 inches thick. The upper 21 inches of the subsoil is dark reddish brown loam. The lower part to a depth of 60 inches is dark brown loam. The depth to bedrock is 60 inches or more.

Included in this unit are small areas of Kanutchan, Pokegema, and Woodcock soils and soils that are similar to the Lobert soil but have bedrock within a depth of 60 inches or are poorly drained. Also included are small areas of Lobert soils that have slopes of more than 12 percent. Included areas make up about 10 percent of the total acreage.

Permeability is moderate in the Lobert soil. Available water capacity is about 9 inches. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of ponderosa pine. The understory vegetation includes antelope bitterbrush, Pacific serviceberry, and Idaho fescue.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 80. The yield at culmination of the mean annual increment is 2,670 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 33,750 board feet per acre (Scribner rule) at 150 years.

The main limitations affecting timber production are compaction, erosion, and seedling mortality. Conventional methods of harvesting timber generally are suitable, but the soil may be compacted if it is moist when heavy equipment is used. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Erosion can be controlled by carefully planning the construction and maintenance of logging roads, skid trails, and landings. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Severe frost can damage or kill seedlings. Air drainage may be restricted on this unit. Proper timber harvesting methods can reduce the effect of frost on regeneration. Reforestation can be accomplished by planting ponderosa pine seedlings.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings.

The main limitation affecting livestock grazing is compaction. The native vegetation suitable for grazing includes Idaho fescue, bluebunch wheatgrass, and western needlegrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Deep Loamy, 16- to 20-inch precipitation zone.

107E—Lorella-Skookum complex, 15 to 35 percent slopes. This map unit is on hillslopes. Elevation is 3,800 to 4,800 feet. The mean annual precipitation is 18 to 20 inches, the mean annual temperature is 45 to 51 degrees F, and the average frost-free period is 100 to 120 days. The native vegetation is mainly grasses, shrubs, and forbs and a few scattered hardwoods and conifers.

This unit is about 55 percent Lorella soil and 25 percent Skookum soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Paragon soils, Rock outcrop on ridges and convex slopes, soils that are similar to the Lorella soil but have bedrock within a depth of 12 inches, and soils that are similar to the Skookum soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Lorella and Skookum soils that have slopes of less than 15 or more than 35 percent. Included areas make up about 20 percent of the total acreage.

The Lorella soil is shallow and well drained. It formed in residuum and colluvium derived dominantly from andesite, tuff, and breccia. Typically, the surface layer is very dark brown extremely stony loam about 5 inches thick. The subsoil is very dark brown and dark brown very cobbly clay loam about 12 inches thick. Bedrock is at a depth of about 17 inches. The depth to bedrock ranges from 12 to 20 inches.

Permeability is slow in the Lorella soil. Available water capacity is about 1 inch. The effective rooting depth is 12 to 20 inches. Runoff is medium, and the hazard of water erosion is moderate.

The Skookum soil is moderately deep and well drained. It formed in residuum and colluvium derived dominantly from andesite, tuff, and breccia. Typically, the surface layer is very dark brown very cobbly loam about 3 inches thick. The next layer is very dark grayish brown very cobbly loam about 5 inches thick. The upper 8 inches of the subsoil is very dark grayish brown very cobbly clay loam. The lower 12 inches is dark brown very cobbly and extremely cobbly clay. Bedrock is at a depth of about 28 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Permeability is slow in the Skookum soil. Available water capacity is about 2 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for livestock grazing and wildlife habitat. The main limitations affecting livestock grazing are compaction, erosion, the stones and cobbles on the surface, and droughtiness. The Lorella soil also is limited by the depth to bedrock. The vegetation suitable for grazing includes Idaho fescue, bluebunch wheatgrass, and pine bluegrass. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment. Because of the stones and cobbles on the surface and the included areas of Rock outcrop, the use of equipment is impractical.

This unit is poorly suited to range seeding. The main limitations are droughtiness, the stones and cobbles on the surface, and the depth to bedrock in the Lorella soil. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the slope and the depth to bedrock.

The vegetative site is Droughty Slopes, 20- to 30-inch precipitation zone.

108B—Manita loam, 2 to 7 percent slopes. This deep, well drained soil is on alluvial fans. It formed in alluvium derived dominantly from metamorphic rock. Elevation is 1,000 to 4,000 feet. The mean annual precipitation is 20 to 40 inches, the mean annual temperature is 47 to 54 degrees F, and the average frost-free period is 100 to 170 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is dark brown loam about 8 inches thick. The upper 5 inches of the subsoil is dark reddish brown clay loam. The lower 45 inches is yellowish red clay loam. Weathered bedrock is at a depth of about 58 inches. The depth to bedrock ranges from 40 to 60 inches. In some areas the surface layer is gravelly.

Included in this unit are small areas of Ruch soils, Darow and Vannoy soils on convex slopes, Selmac soils on concave slopes, Gregory and Medford soils near drainageways and on terraces, and soils that are similar to the Manita soil but have bedrock at a depth of more than 60 inches. Also included are small areas of Manita soils that have slopes of more than 7 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately slow in the Manita soil. Available water capacity is about 8 inches. The effective rooting depth is 40 to 60 inches. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for irrigated crops, such as alfalfa hay, small grain, and tree fruit. Other crops include corn for silage and grass-legume hay. Some areas are used for timber production, pasture, or homesite development.

This unit is well suited to irrigated crops. It is limited mainly by the moderately slow permeability. In summer, irrigation is needed for the maximum production of most crops. Furrow, border, corrugation, trickle, and sprinkler irrigation systems are suitable. The system used generally is governed by the crop that is grown. For the efficient application and removal of surface irrigation water, land leveling is needed. To prevent overirrigation and excessive erosion, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. The use of pipe, ditch lining, or drop structures in irrigation ditches reduces water loss and the hazard of erosion.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Leaving crop residue on or near the surface helps to conserve moisture and control erosion.

A tillage pan forms easily if the soil is tilled when wet. Chiseling or subsoiling breaks up the pan. Surface crusting and compaction can be minimized by returning crop residue to the soil.

Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

Solid-set sprinkler irrigation is the best method of controlling frost and providing adequate moisture for tree fruit. Compaction can be minimized by limiting the use of equipment when the soil is wet. A permanent cover crop helps to control runoff and erosion.

This unit is well suited to homesite development. The main limitations are the moderately slow permeability and the shrink-swell potential. The moderately slow permeability can be overcome by increasing the size of the absorption field.

If buildings are constructed on this unit, properly designing foundations and footings, diverting runoff away from the buildings, and backfilling with material that has a low shrink-swell potential help to prevent the structural damage caused by shrinking and swelling. Properly designing buildings and roads helps to offset the limited ability of the soil to support a load.

Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites.

Topsoil can be stockpiled and used to reclaim areas disturbed during construction. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

This unit is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include incense cedar, California black oak, and Pacific madrone. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and California fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 105. The yield at culmination of the mean annual increment is 5,460 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 45,600 board feet per acre (Scribner rule) at 150 years. On the basis of a 50-year curve, the mean site index is 75.

The main limitations affecting timber production are compaction, seedling mortality, and plant competition. Conventional methods of harvesting timber generally are suitable, but the soil may be compacted if it is moist when heavy equipment is used. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Erosion can be controlled by carefully planning the construction and maintenance of logging roads, skid trails, and landings. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The vegetative site is Pine-Douglas Fir-Fescue.

108D—Manita loam, 7 to 20 percent slopes. This deep, well drained soil is on alluvial fans. It formed in alluvium derived dominantly from metamorphic rock. Elevation is 1,000 to 4,000 feet. The mean annual precipitation is 20 to 40 inches, the mean annual temperature is 47 to 54 degrees F, and the average frost-free period is 100 to 170 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is dark brown loam about 8 inches thick. The upper 5 inches of the subsoil is dark reddish brown clay loam. The lower 45 inches is yellowish red clay loam. Weathered bedrock is at a depth of about 58 inches. The depth to bedrock ranges from 40 to 60 inches. In some areas the surface layer is gravelly.

Included in this unit are small areas of Ruch soils, Darow and Vannoy soils on ridges and convex slopes, Selmac soils on concave slopes, Gregory and Medford soils near drainageways on terraces, and soils that are similar to the Manita soil but have bedrock at a depth of more than 60 inches. Also included are small areas of Manita soils that have slopes of less than 7 or more than 20 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately slow in the Manita soil. Available water capacity is about 8 inches. The effective rooting depth is 40 to 60 inches. Runoff is slow or medium, and the hazard of water erosion is slight or moderate.

This unit is used for irrigated crops, such as alfalfa hay, small grain, tree fruit, and grass-legume hay. It also is used for timber production, pasture, and homesite development.

This unit is suited to irrigated crops. It is limited mainly by the slope and the moderately slow permeability. In summer, irrigation is needed for the maximum production of most crops. Because of the slope, sprinkler irrigation is the best method of applying water. This method permits an even, controlled application of water, helps to prevent excessive runoff, and minimizes the risk of erosion. To prevent overirrigation and excessive erosion, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Leaving crop residue on or near the surface helps to conserve moisture and control erosion.

A tillage pan forms easily if the soil is tilled when wet. Chiseling or subsoiling breaks up the pan. Surface crusting and compaction can be minimized by returning crop residue to the soil.

The hazard of erosion can be reduced if fall grain is seeded early, tillage is minimized, and tillage and seeding are on the contour or across the slope. Also, waterways should be shaped and seeded to perennial grasses.

Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

Solid-set sprinkler irrigation is the best method of controlling frost and providing adequate moisture for tree fruit. Compaction can be minimized by limiting the use of equipment when the soil is wet. A permanent cover crop helps to control runoff and erosion.

The main limitations affecting homesite development are the moderately slow permeability, the shrink-swell potential, and the slope. The moderately slow permeability can be overcome by increasing the size of the absorption field.

If buildings are constructed on this unit, properly designing foundations and footings, diverting runoff away from the buildings, and backfilling with material that has a low shrink-swell potential help to prevent the structural damage caused by shrinking and swelling. Properly designing buildings and roads helps to offset the limited ability of the soil to support a load.

Erosion is a hazard on the steeper slopes. Only the part of the site that is used for construction should be disturbed. Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

This unit is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include incense cedar, California black oak, and Pacific madrone. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and California fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 105. The yield at culmination of the mean annual increment is 5,460 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 45,600 board feet per acre (Scribner rule) at 150 years. On the basis of a 50-year curve, the mean site index is 75.

The main limitations affecting timber production are erosion, compaction, seedling mortality, and plant competition. Conventional methods of harvesting timber generally are suitable, but the soil may be compacted if it is moist when heavy equipment is used. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Erosion can be controlled by carefully planning the construction and maintenance of logging roads, skid trails, and landings. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The vegetative site is Pine-Douglas Fir-Fescue.

108E—Manita loam, 20 to 35 percent slopes. This deep, well drained soil is on alluvial fans and hillslopes. It formed in alluvium and colluvium derived dominantly from metamorphic rock. Elevation is 1,000 to 4,000 feet. The mean annual precipitation is 20 to 40 inches, the mean annual temperature is 47 to 54 degrees F, and the average frost-free period is 100 to 170 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is dark brown loam about 8 inches thick. The upper 5 inches of the subsoil is dark reddish brown clay loam. The lower 45 inches is yellowish red clay loam. Weathered bedrock is at a depth of about 58 inches. The depth to bedrock ranges from 40 to 60 inches. In some areas the surface layer is gravelly.

Included in this unit are small areas of Darow, Vannoy, and Voorhies soils on ridges and convex slopes, Selmac soils on concave slopes, poorly drained soils near drainageways and on concave slopes, Ruch soils on toe slopes, and soils that are similar to the Manita soil but have bedrock at a depth of more than 60 inches. Also included are small areas of Manita soils that have slopes of less than 20 or more than 35 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately slow in the Manita soil. Available water capacity is about 8 inches. The effective rooting depth is 40 to 60 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for hay and pasture, timber production, and homesite development.

The main limitations in the areas used for hay and pasture are the slope, erosion, and compaction. Seedbeds should be prepared on the contour or across the slope where practical. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

The main limitations affecting homesite development are the slope, the moderately slow permeability, and the shrink-swell potential. The moderately slow permeability can be overcome by increasing the size of the absorption field. Because of the slope, the absorption lines should be installed on the contour.

If buildings are constructed on this unit, properly designing foundations and footings, diverting runoff away from the buildings, and backfilling with material that has a low shrink-swell potential help to prevent the structural damage caused by shrinking and swelling. Properly designing buildings and roads helps to offset the limited ability of the soil to support a load.

The slope limits the use of the steeper parts of the landscape for building site development because of the risk of erosion. Only the part of the site that is used for construction should be disturbed. Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

This unit is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include incense cedar, California black oak, and Pacific madrone. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and California fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 105. The yield at culmination of the mean annual increment is 5,460 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 45,600 board feet per acre (Scribner rule) at 150 years. On the basis of a 50-year curve, the mean site index is 75.

The main limitations affecting timber production are erosion, compaction, seedling mortality, and plant competition. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer result in a high seedling mortality rate, especially on south- and southwest-facing slopes. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The vegetative site is Pine-Douglas Fir-Fescue.

108F—Manita loam, 35 to 50 percent slopes. This deep, well drained soil is on hillslopes. It formed in colluvium derived dominantly from metamorphic rock. Elevation is 1,000 to 4,000 feet. The mean annual precipitation is 20 to 40 inches, the mean annual temperature is 47 to 54 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is dark brown loam about 8 inches thick. The upper 5 inches of the subsoil is dark reddish brown clay loam. The lower 45 inches is yellowish red clay loam. Weathered bedrock is at a depth of about 58 inches. The depth to bedrock ranges from 40 to 60 inches. In some areas the surface layer is gravelly or very gravelly.

Included in this unit are small areas of Vannoy and Voorhies soils, soils that are similar to the Manita soil but have bedrock at a depth of more than 60 inches, Ruch soils on toe slopes, Selmac soils on concave slopes, and McMullin soils on ridges and on convex slopes. Also included are small areas of Manita soils that have slopes of less than 35 or more than 50 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderately slow in the Manita soil. Available water capacity is about 8 inches. The effective rooting depth is 40 to 60 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include incense cedar, California black oak, and Pacific madrone. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and California fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 105. The yield at culmination of the mean annual increment is 5,460 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 45,600 board feet per acre (Scribner rule) at 150 years. On the basis of a 50-year curve, the mean site index is 75.

The main limitations affecting timber production are the slope, erosion, compaction, seedling mortality, and plant competition. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

Constructing logging roads on the steeper parts of the landscape can result in a high risk of erosion. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation.

This unit is subject to slumping. Road failure and landslides are likely to occur after road construction and clearcutting. Slumping can be minimized by constructing logging roads in the less sloping areas, on better suited soils if practical, and by installing properly designed road drainage systems. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer result in a high seedling mortality rate, especially on south- and southwest-facing slopes. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced on south- and southwest-facing slopes by providing artificial shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The vegetative site is Pine-Douglas Fir-Fescue.

109E—Manita-Vannoy complex, 20 to 40 percent slopes. This map unit is on alluvial fans and hillslopes. Elevation is 1,000 to 4,000 feet. The mean annual precipitation is 20 to 40 inches, the mean annual temperature is 47 to 54 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 55 percent Manita soil and 35 percent Vannoy soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used. The Manita soil is commonly on the less sloping parts of the landscape.

Included in this unit are small areas of Darow and Voorhies soils on ridges and convex slopes, Selmac soils on concave slopes, poorly drained soils near drainageways, Ruch soils on toe slopes, and soils that are similar to the Manita soil but have bedrock at a depth of more than 60 inches. Also included are small areas of Manita soils that have slopes of less than 20 or more than 40 percent. Included areas make up about 10 percent of the total acreage.

The Manita soil is deep and well drained. It formed in alluvium and colluvium derived dominantly from metamorphic rock. Typically, the surface layer is dark brown loam about 8 inches thick. The upper 5 inches of the subsoil is dark reddish brown clay loam. The lower 45 inches is yellowish red clay loam. Weathered bedrock is at a depth of about 58 inches. The depth to bedrock ranges from 40 to 60 inches. In some areas the surface layer is gravelly.

Permeability is moderately slow in the Manita soil. Available water capacity is about 8 inches. The effective rooting depth is 40 to 60 inches. Runoff is medium or rapid, and the hazard of water erosion is moderate or high.

The Vannoy soil is moderately deep and well drained. It formed in colluvium derived dominantly from metamorphic rock. Typically, the surface is covered with a layer of needles, leaves, and twigs about ¾ inch thick. The surface layer is dark brown silt loam about 4 inches thick. The next layer is reddish brown silt loam about 7 inches thick. The subsoil is yellowish red clay loam about 27 inches thick. Weathered bedrock is at a depth of about 38 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is gravelly or very gravelly.

Permeability is moderately slow in the Vannoy soil. Available water capacity is about 5 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium or rapid, and the hazard of water erosion is moderate or high.

This unit is used for hay and pasture, timber production, and homesite development.

The main limitations in the areas used for hay and pasture are the slope, erosion, and compaction. This unit is not suitable for irrigation because of the slope. Seedbeds should be prepared on the contour or across the slope where practical. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soils from erosion. Grazing when the soils are wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

The main limitations affecting homesite development are the depth to bedrock in the Vannoy soil, the shrink-swell potential of the Manita soil, and the slope and moderately slow permeability of both soils. The moderately slow permeability can be overcome by increasing the size of the absorption field. Because of the slope, the absorption lines should be installed on the contour. The deeper and less sloping areas of the Vannoy soil may be suited to septic tank absorption fields. Onsite investigation is needed to locate such areas.

The slope limits the use of the steeper areas of this unit for building site development. Cuts needed to provide essentially level building sites can expose bedrock. If buildings are constructed on the Manita soil, properly designing foundations and footings, diverting runoff away from the buildings, and backfilling with material that has a low shrink-swell potential help to prevent the structural damage caused by shrinking and swelling. Properly designing buildings and roads helps to offset the limited ability of the Manita soil to support a load.

Erosion is a hazard on the steeper parts of the landscape. Only the part of the site that is used for construction should be disturbed. Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

This unit is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include incense cedar, California black oak, and Pacific madrone. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and California fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 105 on both the Manita and Vannoy soils. The yield at culmination of the mean annual increment is 5,460 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 45,600 board feet per acre (Scribner rule) at 150 years. On the basis of a 50-year curve, the mean site index is 75.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 90 on the Vannoy soil. The yield at culmination of the mean annual increment is 3,400 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 37,960 board feet per acre (Scribner rule) at 130 years.

The main limitations affecting timber production are erosion, compaction, the slope, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. Using standard wheeled and tracked equipment when the soils are moist causes rutting and compaction. Puddling can occur when the soils are wet. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both.

The Manita soil may be subject to slumping; therefore, road failure and landslides are likely to occur after road construction and clearcutting. Slumping can be minimized by constructing logging roads in the less sloping areas, on better suited soils if practical, and by installing properly designed road drainage systems. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer result in a high seedling mortality rate, especially on south- and southwest-facing slopes. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced on south- and southwest-facing slopes by providing artificial shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The vegetative site is Pine-Douglas Fir-Fescue.

110E—McMullin gravelly loam, 3 to 35 percent slopes. This shallow, well drained soil is on hillslopes. It formed in colluvium derived dominantly from igneous and metamorphic rock. Elevation is 1,000 to 4,000 feet. The mean annual precipitation is 18 to 40 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 180 days. The native vegetation is mainly grasses, shrubs, and forbs.

Typically, the surface layer is dark reddish brown gravelly loam about 7 inches thick. The subsoil is dark reddish brown gravelly clay loam about 10 inches thick. Bedrock is at a depth of about 17 inches. The depth to bedrock ranges from 12 to 20 inches. In some areas the surface layer is stony.

Included in this unit are small areas of McNull soils, Carney and Medco soils on concave slopes, Rock outcrop on ridges and convex slopes, poorly drained soils near drainageways and on concave slopes, and soils that are similar to the McMullin soil but have more than 35 percent rock fragments or are less than 12 inches or more than 20 inches deep over bedrock. Also included are McMullin soils that have slopes of more than 35 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderate in the McMullin soil. Available water capacity is about 2 inches. The effective rooting depth is 12 to 20 inches. Runoff is slow or medium, and the hazard of water erosion is slight or moderate.

This unit is used for livestock grazing and wildlife habitat The main limitations affecting livestock grazing are compaction, erosion, droughtiness, and the depth to bedrock. The vegetation suitable for grazing includes bluebunch wheatgrass, Lemmon needlegrass, and pine bluegrass. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment. In places the use of ground equipment is limited by the included areas of stony soils and Rock outcrop.

This unit is poorly suited to range seeding. The main limitations are the depth to bedrock, droughtiness, and the included areas of stony soils and Rock outcrop. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the slope and the depth to bedrock.

The vegetative site is Loamy Shrub Scabland, 18- to 35-inch precipitation zone.

111G—McMullin-McNull gravelly loams, 35 to 60 percent south slopes. This map unit is on hillslopes. Elevation is 1,500 to 4,000 feet. The mean annual precipitation is 20 to 40 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation on the McMullin soil is mainly grasses, shrubs, and forbs. That on the McNull soil is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 60 percent McMullin soil and 25 percent McNull soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Medco soils on concave slopes, Rock outcrop on ridges and convex slopes, poorly drained soils near drainageways and on concave slopes, soils that are similar to the McNull soil but have bedrock at a depth of more than 40 inches, soils that are similar to the McMullin soil but have bedrock at a depth of less than 12 or more than 20 inches, and soils that are similar to the McNull and McMullin soils but have more than 35 percent rock fragments. Also included are small areas of McNull and McMullin soils that have slopes of less than 35 or more than 60 percent. Included areas make up about 15 percent of the total acreage.

The McMullin soil is shallow and well drained. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Typically, the surface layer is dark reddish brown gravelly loam about 7 inches thick. The subsoil is dark reddish brown gravelly clay loam about 10 inches thick. Bedrock is at a depth of about 17 inches. The depth to bedrock ranges from 12 to 20 inches. In some areas the surface layer is stony.

Permeability is moderate in the McMullin soil. Available water capacity is about 2 inches. The effective rooting depth is 12 to 20 inches. Runoff is rapid, and the hazard of water erosion is high.

The McNull soil is moderately deep and well drained. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is dark reddish brown gravelly loam about 6 inches thick. The upper 6 inches of the subsoil is dark reddish brown clay loam. The lower 20 inches is dark reddish brown cobbly clay. Weathered bedrock is at a depth of about 32 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony or cobbly.

Permeability is slow in the McNull soil. Available water capacity is about 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used mainly for livestock grazing or wildlife habitat. The McNull soil also is used for timber production.

The main limitations affecting livestock grazing are the slope, erosion, and compaction. The McMullin soil also is limited by the depth to bedrock. The vegetation suitable for grazing includes Idaho fescue, bluebunch wheatgrass, and pine bluegrass on the McMullin soil and Idaho fescue, western fescue, and tall trisetum on the McNull soil. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Mechanical treatment is not practical because of the slope and the included areas of Rock outcrop and stony soils.

This unit is poorly suited to range seeding. The main limitations are the slope of both soils and the depth to bedrock in the McMullin soil.

The slope limits access by livestock. As a result, the less sloping areas tend to be overgrazed. Constructing trails or walkways allows livestock to graze in areas where access is limited.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the slope and the depth to bedrock.

Thinning, logging, and fire on the McNull soil reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment.

The McNull soil is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include incense cedar, California black oak, and Pacific madrone. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and California fescue.

On the basis of a 100 year site curve, the mean site index for Douglas fir is 95 on the McNull soil. The yield at culmination of the mean annual increment is 4,620 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 37,120 board feet per acre (Scribner rule) at 160 years. On the basis of a 50-year curve, the mean site index is 70.

The main limitations affecting timber production on the McNull soil are the slope, erosion, compaction, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Building the roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced by providing artificial shade for seedlings. Reforestation can be accomplished by planting ponderosa pine and Douglas fir seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The vegetative site in areas of the McMullin soil is Shallow Mountain Slopes, 22- to 30-inch precipitation zone, and the one in areas of the McNull soil is Pine-Douglas Fir-Fescue.

112F—McMullin-Medco complex, 12 to 50 percent slopes. This map unit is on hillslopes (fig. 9). Elevation is 1,300 to 4,000 feet. The mean annual precipitation is 20 to 35 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation on the McMullin soil is mainly grasses, shrubs, and forbs. That on the Medco soil is mainly hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 50 percent McMullin soil and 30 percent Medco soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Carney and McNull soils, Rock outcrop on ridges and convex slopes, and soils that are similar to the McMullin soil but have more than 35 percent rock fragments or have bedrock at a depth of less than 12 or more than 20 inches. Also included are small areas of soils that are similar to the Medco soil but have bedrock at a depth of more than 40 inches, poorly drained soils near drainageways and on concave slopes, and Medco and McMullin soils that have slopes of less than 12 or more than 50 percent. Included areas make up about 20 percent of the total acreage.

The McMullin soil is shallow and well drained. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Typically, the surface layer is dark reddish brown gravelly loam about 7 inches thick. The subsoil is dark reddish brown gravelly clay loam about 10 inches thick. Bedrock is at a depth of about 17 inches. The depth to bedrock ranges from 12 to 20 inches. In some areas the surface layer is stony.

Permeability is moderate in the McMullin soil. Available water capacity is about 2 inches. The effective

Figure 9.—An area of McMullin-Medco complex, 12 to 50 percent slopes. The shallow McMullin soil is in the foreground, and the moderately deep Medco soil is in the background.

rooting depth is 12 to 20 inches. Runoff is medium, and the hazard of water erosion is moderate.

The Medco soil is moderately deep and moderately well drained. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Typically, the surface layer is very dark brown and very dark grayish brown cobbly clay loam about 7 inches thick. The next layer is very dark grayish brown cobbly clay loam about 5 inches thick. The subsoil is brown clay about 18 inches thick. Weathered bedrock is at a depth of about 30 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Permeability is very slow in the Medco soil. Available water capacity is about 4 inches. The effective rooting depth is limited by a dense layer of clay at a depth of 6 to 18 inches. Runoff is medium, and the hazard of water erosion is moderate. The water table, which is perched above the layer of clay, is at a depth of 0.5 foot to 1.5 feet from December through March.

This unit is used for livestock grazing and wildlife habitat. The main limitations affecting livestock grazing on the McMullin soil are erosion, compaction, the depth to bedrock, droughtiness, and the slope. The main limitations in areas of the Medco soil are erosion, compaction, cobbles and stones on the surface, wetness in winter and spring, droughtiness in summer and fall, and the slope. The vegetation suitable for grazing includes Idaho fescue, bluebunch wheatgrass, and pine bluegrass. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

Because the Medco soil remains wet for long periods in spring, grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock. Compaction can be minimized by grazing first in the areas that dry out earliest.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. In places the use of ground equipment is limited by the wetness, the slope, and the included areas of stony soils and Rock outcrop.

Range seeding is suitable on the Medco soil if the site is in poor condition. The main limitations are wetness in winter and spring and droughtiness in summer and fall. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both. The suitability of the McMullin soil for seeding is poor. The main limitations are the depth to bedrock and droughtiness.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the slope and the depth to bedrock.

The vegetative site in areas of the McMullin soil is Loamy Shrub Scabland, 18- to 35-inch precipitation zone, and the one in areas of the Medco soil is Loamy Hills, 20- to 35-inch precipitation zone.

113E—McMullin-Rock outcrop complex, 3 to 35 percent slopes. This map unit is on hillslopes. Elevation is 1,000 to 4,000 feet. The mean annual precipitation is 18 to 40 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 180 days. The native vegetation is mainly grasses, shrubs, and forbs.

This unit is about 60 percent McMullin soil and 25 percent Rock outcrop. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Lorella and Skookum soils, McNull soils on north-facing slopes, Carney and Medco soils on concave slopes, poorly drained soils near drainageways and on concave slopes, and soils that are similar to the McMullin soil but have more than 35 percent rock fragments or are less than 12 inches or more than 20 inches deep over bedrock. Also included are small areas of McMullin soils that have slopes of more than 35 percent. Included areas make up about 15 percent of the total acreage.

The McMullin soil is shallow and well drained. It formed in colluvium derived dominantly from igneous and metamorphic rock. Typically, the surface layer is dark reddish brown gravelly loam about 7 inches thick. The subsoil is dark reddish brown gravelly clay loam about 10 inches thick. Bedrock is at a depth of about 17 inches. The depth to bedrock ranges from 12 to 20 inches.

Permeability is moderate in the McMullin soil. Available water capacity is about 2 inches. The effective rooting depth is 12 to 20 inches. Runoff is slow or medium, and the hazard of water erosion is slight or moderate.

Rock outcrop consists of areas of exposed bedrock. Runoff is very rapid in these areas.

This unit is used for livestock grazing and wildlife habitat. The main limitations affecting livestock grazing are compaction, erosion, the Rock outcrop, stones on the surface, droughtiness, and the depth to bedrock. The vegetation suitable for grazing includes bluebunch wheatgrass, Lemmon needlegrass, and pine bluegrass. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment. The use of ground equipment is not practical because of the stones on the surface and the included areas of Rock outcrop.

This unit is poorly suited to range seeding. The main limitations are the depth to bedrock, droughtiness, the stones on the surface, and the Rock outcrop. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the slope and the depth to bedrock.

The vegetative site is Loamy Shrub Scabland, 18- to 35-inch precipitation zone.

113G—McMullin-Rock outcrop complex, 35 to 60 percent slopes. This map unit is on hillslopes. Elevation is 1,000 to 4,000 feet. The mean annual precipitation is 18 to 40 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 180 days. The native vegetation is mainly grasses, shrubs, and forbs.

This unit is about 60 percent McMullin soil and 30 percent Rock outcrop. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Lorella and Skookum soils, McNull soils on north-facing slopes, Carney and Medco soils on concave slopes, and poorly drained soils near drainageways and on concave slopes. Also included are small areas of soils that are similar to the McMullin soil but have more than 35 percent rock fragments or are less than 12 inches or more than 20 inches deep over bedrock and McMullin soils that have slopes of less than 35 or more than 60 percent. Included areas make up about 10 percent of the total acreage.

The McMullin soil is shallow and well drained. It formed in colluvium derived dominantly from igneous and metamorphic rock. Typically, the surface layer is dark reddish brown gravelly loam about 7 inches thick. The subsoil is dark reddish brown gravelly clay loam about 10 inches thick. Bedrock is at a depth of about 17 inches. The depth to bedrock ranges from 12 to 20 inches.

Permeability is moderate in the McMullin soil. Available water capacity is about 2 inches. The effective rooting depth is 12 to 20 inches. Runoff is rapid, and the hazard of water erosion is high.

Rock outcrop consists of areas of exposed bedrock. Runoff is very rapid in these areas.

This unit is used for livestock grazing and wildlife habitat. The main limitations affecting livestock grazing are the slope, erosion, compaction, the Rock outcrop, stones on the surface, droughtiness, and the depth to bedrock. The vegetation suitable for grazing includes Idaho fescue, bluebunch wheatgrass, and pine bluegrass. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment. The use of ground equipment is not practical because of the stones on the surface, the Rock outcrop, and the slope.

This unit is poorly suited to range seeding. The main limitations are the slope, the depth to bedrock, droughtiness, the stones on the surface, and the Rock outcrop. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

The slope and the Rock outcrop limit access by livestock. As a result, the less sloping areas tend to be overgrazed. Constructing trails or walkways allows livestock to graze in areas where access is limited.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the slope and the depth to bedrock.

The vegetative site is Shallow Mountain Slopes, 22- to 30-inch precipitation zone.

114E—McNull loam, 12 to 35 percent north slopes. This moderately deep, well drained soil is on hillslopes. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Elevation is 1,500 to 4,000 feet. The mean annual precipitation is 25 to 40 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is dark reddish brown loam about 6 inches thick. The upper 6 inches of the subsoil is dark reddish brown clay loam. The lower 20 inches is dark reddish brown cobbly clay. Weathered bedrock is at a depth of about 32 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony or cobbly.

Included in this unit are small areas of McMullin soils and Rock outcrop on ridges and convex slopes, Medco soils on concave slopes, poorly drained soils near drainageways and on concave slopes, and soils that are similar to the McNull soil but have bedrock at a depth of more than 40 inches or have more than 35 percent rock fragments. Also included are small areas of McNull soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 20 percent of the total acreage.

Permeability is slow in the McNull soil. Available water capacity is about 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include incense cedar, California black oak, and Pacific madrone. The understory vegetation includes creambush oceanspray, common snowberry, and tall Oregon grape.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 105. The yield at culmination of the mean annual increment is 5,460 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 45,600 board feet per acre (Scribner rule) at 150 years. On the basis of a 50-year curve, the mean site index is 80.

The main limitations affecting timber production are erosion, compaction, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The main limitations affecting livestock grazing are compaction and erosion. The native vegetation suitable for grazing includes western fescue, mountain brome, and tall trisetum. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Douglas Fir Forest.

114G—McNull loam, 35 to 60 percent north slopes. This moderately deep, well drained soil is on hillslopes. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Elevation is 1,500 to 4,000 feet. The mean annual precipitation is 25 to 40 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is dark reddish brown loam about 6 inches thick. The upper 6 inches of the subsoil is dark reddish brown clay loam. The lower 20 inches is dark reddish brown cobbly clay. Weathered bedrock is at a depth of about 32 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony or cobbly.

Included in this unit are small areas of McMullin soils and Rock outcrop on ridges and convex slopes, Medco soils on concave slopes, poorly drained soils near drainageways and on concave slopes, and soils that are similar to the McNull soil but have bedrock at a depth of more than 40 inches or have more than 35 percent rock fragments. Also included are small areas of McNull soils that have slopes of less than 35 or more than 60 percent. Included areas make up about 20 percent of the total acreage.

Permeability is slow in the McNull soil. Available water capacity is about 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include incense cedar, California black oak, and Pacific madrone. The understory vegetation includes creambush oceanspray, common snowberry, and tall Oregon grape.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 105. The yield at culmination of the mean annual increment is 5,460 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 45,600 board feet per acre (Scribner rule) at 150 years. On the basis of a 50-year curve, the mean site index is 80.

The main limitations affecting timber production are the slope, erosion, compaction, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is wet and susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Building the roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The main limitations affecting livestock grazing are erosion, compaction, and the slope. The native vegetation suitable for grazing includes western fescue, mountain brome, and tall trisetum. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Douglas Fir Forest.

115E—McNull gravelly loam, 12 to 35 percent south slopes. This moderately deep, well drained soil is on hillslopes. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Elevation is 1,500 to 4,000 feet. The mean annual precipitation is 25 to 40 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to

160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is dark reddish brown gravelly loam about 6 inches thick. The upper 6 inches of the subsoil is dark reddish brown clay loam. The lower 20 inches is dark reddish brown cobbly clay. Weathered bedrock is at a depth of about 32 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony or cobbly.

Included in this unit are small areas of McMullin soils and Rock outcrop on ridges and convex slopes, Medco soils on concave slopes, poorly drained soils near drainageways and on concave slopes, and soils that are similar to the McNull soil but have bedrock at a depth of more than 40 inches or have more than 35 percent rock fragments. Also included are small areas of McNull soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 20 percent of the total acreage.

Permeability is slow in the McNull soil. Available water capacity is about 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include incense cedar, California black oak, and Pacific madrone. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and California fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 95. The yield at culmination of the mean annual increment is 4,620 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 37,120 board feet per acre (Scribner rule) at 160 years. On the basis of a 50-year curve, the mean site index is 70.

The main limitations affecting timber production are erosion, compaction, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The main limitations affecting livestock grazing are compaction and erosion. The native vegetation suitable for grazing includes Idaho fescue, tall trisetum, and western fescue. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Pine-Douglas Fir-Fescue.

115G—McNull gravelly loam, 35 to 60 percent south slopes. This moderately deep, well drained soil is on hillslopes. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Elevation is 1,500 to 4,000 feet. The mean annual precipitation is 25 to 40 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is dark reddish brown gravelly loam about 6 inches thick. The upper 6 inches of the subsoil is dark reddish brown clay loam. The lower 20 inches is dark reddish brown cobbly clay. Weathered bedrock is at a depth of about 32 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony or cobbly.

Included in this unit are small areas of McMullin soils and Rock outcrop on ridges and convex slopes, Medco soils on concave slopes, poorly drained soils near drainageways and on concave slopes, and soils that are similar to the McNull soil but have bedrock at a depth of more than 40 inches or have more than 35 percent rock fragments. Also included are small areas of McNull soils that have slopes of less than 35 or more than 60 percent. Included areas make up about 20 percent of the total acreage.

Permeability is slow in the McNull soil. Available water capacity is about 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include incense cedar, California black oak, and Pacific madrone. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and California fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 95. The yield at culmination of the mean annual increment is 4,620 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 37,120 board feet per acre (Scribner rule) at 160 years. On the basis of a 50-year curve, the mean site index is 70.

The main limitations affecting timber production are the slope, erosion, compaction, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Building the roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced by providing artificial shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The main limitations affecting livestock grazing are erosion, compaction, and the slope. The native vegetation suitable for grazing includes Idaho fescue, tall trisetum, and western fescue. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Pine-Douglas Fir-Fescue.

116E—McNull-McMullin gravelly loams, 12 to 35 percent south slopes. This map unit is on hillslopes. Elevation is 1,500 to 4,000 feet. The mean annual precipitation is 20 to 40 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation on the McNull soil is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs. That on the McMullin soil is mainly grasses, shrubs, and forbs.

This unit is about 55 percent McNull soil and 30 percent McMullin soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Medco soils on concave slopes, Rock outcrop on ridges and convex slopes, poorly drained soils near drainageways and on concave slopes, and soils that are similar to the McNull soil but have bedrock at a depth of more than 40 inches. Also included are small areas of soils that are similar to the McMullin soil but have bedrock at a depth of less than 12 or more than 20 inches, soils that are similar to the McNull and McMullin soils but have more than 35 percent rock fragments, and McNull and McMullin soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 15 percent of the total acreage.

The McNull soil is moderately deep and well drained. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is dark reddish brown gravelly loam about 6 inches thick. The upper 6 inches of the subsoil is dark reddish brown clay loam. The lower 20 inches is dark reddish brown cobbly clay. Weathered bedrock is at a depth of about 32 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony or cobbly.

Permeability is slow in the McNull soil. Available water capacity is about 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

The McMullin soil is shallow and well drained. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Typically, the surface layer is dark reddish brown gravelly loam about 7 inches thick. The subsoil is dark reddish brown gravelly clay loam about 10 inches thick. Bedrock is at a depth of about 17 inches. The depth to bedrock ranges from 12 to 20 inches. In some areas the surface layer is stony.

Permeability is moderate in the McMullin soil. Available water capacity is about 2 inches. The effective rooting depth is 12 to 20 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for timber production, livestock grazing, and wildlife habitat.

The McNull soil is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include incense cedar, California black oak, and Pacific madrone. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and California fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 95 on the McNull soil. The yield at culmination of the mean annual increment is 4,620 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 37,120 board feet per acre (Scribner rule) at 160 years. On the basis of a 50-year curve, the mean site index is 70.

The main limitations affecting timber production on the McNull soil are erosion, compaction, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding

paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The main limitations affecting livestock grazing are compaction and erosion. The McMullin soil also is limited by droughtiness and the depth to bedrock. The vegetation suitable for grazing includes Idaho fescue, tall trisetum, and western fescue on the McNull soil and bluebunch wheatgrass, Lemmon needlegrass, and pine bluegrass on the McMullin soil. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Mechanical treatment may not be practical in all areas because of the included Rock outcrop and stony soils.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion. The McMullin soil is poorly suited to seeding, however, because of droughtiness and the depth to bedrock.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the slope and the depth to bedrock.

The vegetative site in areas of the McNull soil is Pine-Douglas Fir-Fescue, and the one in areas of the McMullin soil is Loamy Shrub Scabland, 18- to 35-inch precipitation zone.

116G—McNull-McMullin gravelly loams, 35 to 60 percent south slopes. This map unit is on hillslopes. Elevation is 1,500 to 4,000 feet. The mean annual precipitation is 20 to 40 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation on the McNull soil is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs. That on the McMullin soil is mainly grasses, shrubs, and forbs.

This unit is about 55 percent McNull soil and 30 percent McMullin soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Medco soils on concave slopes, Rock outcrop on ridges and convex slopes, poorly drained soils near drainageways and on concave slopes, and soils that are similar to the McNull soil but have bedrock at a depth of more than 40 inches. Also included are small areas of soils that are similar to the McMullin soil but have bedrock at a depth of less than 12 or more than 20 inches, areas of soils that are similar to the McNull and McMullin soils but have more than 35 percent rock fragments, and McNull and McMullin soils that have slopes of less than 35 or more than 60 percent. Included areas make up about 15 percent of the total acreage.

The McNull soil is moderately deep and well drained. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is dark reddish brown gravelly loam about 6 inches thick. The upper 6 inches of the subsoil is dark reddish brown clay loam. The lower 20 inches is dark reddish brown cobbly clay. Weathered bedrock is at a depth of about 32 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony or cobbly.

Permeability is slow in the McNull soil. Available water capacity is about 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

The McMullin soil is shallow and well drained. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Typically, the surface layer is dark reddish brown gravelly loam about 7 inches thick. The subsoil is dark reddish brown gravelly clay loam about 10 inches thick. Bedrock is at a depth of about 17 inches. The depth to bedrock ranges from 12 to 20 inches. In some areas the surface layer is stony.

Permeability is moderate in the McMullin soil.

Available water capacity is about 2 inches. The effective rooting depth is 12 to 20 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production, livestock grazing, and wildlife habitat.

The McNull soil is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include incense cedar, California black oak, and Pacific madrone. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and California fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 95 on the McNull soil. The yield at culmination of the mean annual increment is 4,620 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 37,120 board feet per acre (Scribner rule) at 160 years. On the basis of a 50-year curve, the mean site index is 70.

The main limitations affecting timber production on the McNull soil are the slope, erosion, compaction, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Building the roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced by providing artificial shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The main limitations affecting livestock grazing are the slope, erosion, and compaction. The McMullin soil also is limited by droughtiness and the depth to bedrock. The vegetation suitable for grazing includes Idaho fescue, tall trisetum, and western fescue on the McNull soil and Idaho fescue, bluebunch wheatgrass, and pine bluegrass on the McMullin soil. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Mechanical treatment generally is not practical because of the slope and the included areas of Rock outcrop and stony soils.

The suitability of this unit for seeding is poor. The main limitations affecting seeding are the slope, droughtiness, and the depth to bedrock in the McMullin soil.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the slope and the depth to bedrock.

The vegetative site in areas of the McNull soil is Pine-Douglas Fir-Fescue, and the one in areas of the McMullin soil is Shallow Mountain Slopes, 22- to 30-inch precipitation zone.

117G—McNull-McMullin complex, 35 to 60 percent north slopes. This map unit is on hillslopes. Elevation is 1,500 to 4,000 feet. The mean annual precipitation is 20 to 40 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation on the McNull soil is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs. That on the McMullin soil is mainly grasses, shrubs, and forbs.

This unit is about 55 percent McNull soil and 30 percent McMullin soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Medco soils on concave slopes, Rock outcrop on ridges and convex slopes, poorly drained soils near drainageways and on concave slopes, and soils that are similar to the McNull soil but have bedrock at a depth of more than 40 inches. Also included are small areas of soils that are similar to the McMullin soil but have bedrock at a depth of less than 12 or more than 20 inches, soils that are similar to the McNull and McMullin soils but have more than 35 percent rock fragments, and McNull and McMullin soils that have slopes of less than 35 or more than 60 percent. Included areas make up about 15 percent of the total acreage.

The McNull soil is moderately deep and well drained. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is dark reddish brown loam about 6 inches thick. The upper 6 inches of the subsoil is dark reddish brown clay loam. The lower 20 inches is dark reddish brown cobbly clay. Weathered bedrock is at a depth of about 32 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony or cobbly.

Permeability is slow in the McNull soil. Available water capacity is about 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

The McMullin soil is shallow and well drained. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Typically, the surface layer is dark reddish brown gravelly loam about 7 inches thick. The subsoil is dark reddish brown gravelly clay loam about 10 inches thick. Bedrock is at a depth of about 17 inches. The depth to bedrock ranges from 12 to 20 inches. In some areas the surface layer is stony.

Permeability is moderate in the McMullin soil. Available water capacity is about 2 inches. The effective rooting depth is 12 to 20 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production, livestock grazing, and wildlife habitat.

The McNull soil is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include incense cedar, California black oak, and Pacific madrone. The understory vegetation includes creambush oceanspray, common snowberry, and tall Oregon grape.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 105 on the McNull soil. The yield at culmination of the mean annual increment is 5,460 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 45,600 board feet per acre (Scribner rule) at 150 years. On the basis of a 50-year curve, the mean site index is 80.

The main limitations affecting timber production on the McNull soil are the slope, erosion, compaction, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Building the roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The main limitations affecting livestock grazing are the slope, erosion, and compaction. The McMullin soil also is limited by droughtiness and the depth to bedrock. The vegetation suitable for grazing includes western fescue, mountain brome, and tall trisetum on the McNull soil and Idaho fescue and pine bluegrass on the McMullin soil. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment. The use of ground equipment generally is not practical because of the slope and the included areas of Rock outcrop and stony soils.

The suitability of this unit for seeding is poor. The main limitations are the slope, droughtiness, and the depth to bedrock in the McMullin soil. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the slope and the depth to bedrock.

The vegetative site in areas of the McNull soil is Douglas Fir Forest, and the one in areas of the McMullin soil is Droughty North, 18- to 35-inch precipitation zone.

118E—McNull-Medco complex, 12 to 50 percent slopes. This map unit is on hillslopes. Elevation is 1,500 to 4,000 feet. The mean annual precipitation is 20 to 35 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation on the McNull soil is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs. That on the Medco soil is mainly hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 55 percent McNull soil and 35 percent Medco soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of McMullin soils on ridges and convex slopes, poorly drained soils near drainageways, soils that are similar to the McNull and Medco soils but have bedrock at a depth of more than 40 inches, and soils that are similar to the Medco soil but are 18 to 30 inches deep to a dense layer of clay. Also included are small areas of soils that have slopes of less than 12 or more than 50 percent. Included areas make up about 10 percent of the total acreage.

The McNull soil is moderately deep and well drained. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is dark reddish brown gravelly loam about 6 inches thick. The upper 6 inches of the subsoil is dark reddish brown clay loam. The lower 20 inches is dark reddish brown cobbly clay. Weathered bedrock is at a depth of about 32 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony or cobbly.

Permeability is slow in the McNull soil. Available water capacity is about 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium or rapid, and the hazard of water erosion is moderate or high.

The Medco soil is moderately deep and moderately well drained. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Typically, the surface layer is very dark brown and very dark grayish brown cobbly clay loam about 7 inches thick. The next layer is very dark grayish brown cobbly clay loam about 5 inches thick. The subsoil is brown clay about 18 inches thick. Weathered bedrock is at a depth of about 30 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Permeability is very slow in the Medco soil. Available water capacity is about 4 inches. The effective rooting depth is limited by a dense layer of clay at a depth of 6 to 18 inches. Runoff is medium or rapid, and the hazard of water erosion is moderate or high. The water table, which is perched above the layer of clay, is at a depth of 0.5 foot to 1.5 feet from December through March.

This unit is used mainly for livestock grazing or wildlife habitat. The McNull soil also is used for timber production.

The McNull soil is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include incense cedar, California black oak, and Pacific madrone. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and California fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 95 on the McNull soil. The yield at culmination of the mean annual increment is 4,620 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 37,120 board feet per acre (Scribner rule) at 160 years. On the basis of a 50-year curve, the mean site index is 70.

The main limitations affecting timber production on the McNull soil are erosion, compaction, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both.

The Medco soil, which occurs throughout the unit, is subject to severe slumping. Road failure and landslides are likely to occur after road construction and clearcutting. Slumping can be minimized by constructing logging roads in the less sloping areas, on better suited soils if practical, and by installing properly designed road drainage systems. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate, especially on south- and southwest-facing slopes. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The main limitations affecting livestock grazing are compaction, erosion, and the slope. The Medco soil also is limited by cobbles on the surface and wetness in winter and spring. The vegetation suitable for grazing includes Idaho fescue, tall trisetum, and western fescue on the McNull soil and Idaho fescue, bluebunch wheatgrass, and pine bluegrass on the Medco soil. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soils. Because the Medco soil remains wet for long periods in spring, grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock. Compaction can be minimized by grazing first in the areas that dry out earliest.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. In places the use of ground equipment is limited by the seasonal wetness, the slope, and the included areas of stony soils and Rock outcrop.

Range seeding is suitable on the Medco soil if the site is in poor condition. The main limitations are wetness in winter and spring and droughtiness in summer and fall. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

The vegetative site in areas of the McNull soil is Pine-Douglas Fir-Fescue, and the one in areas of the Medco soil is Loamy Hills, 20- to 35-inch precipitation zone.

119F—McNull-Medco complex, high precipitation, 12 to 50 percent slopes. This map unit is on hillslopes. Elevation is 2,500 to 4,000 feet. The mean annual precipitation is 35 to 40 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 50 percent McNull soil and 35 percent Medco soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of McMullin soils on ridges and convex slopes, poorly drained soils near drainageways, soils that are similar to the McNull and Medco soils but have bedrock at a depth of more than 40 inches, and soils that are similar to the Medco soil but are 18 to 30 inches deep to a dense layer of clay. Also included are small areas of McNull and Medco soils that have slopes of less than 12 or more than 50 percent. Included areas make up about 15 percent of the total acreage.

The McNull soil is moderately deep and well drained. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is dark reddish brown loam about 6 inches thick. The upper 6 inches of the subsoil is dark reddish brown clay loam. The lower 20 inches is dark reddish brown cobbly clay. Weathered bedrock is at a depth of about 32 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony or cobbly.

Permeability is slow in the McNull soil. Available water capacity is about 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium or rapid, and the hazard of water erosion is moderate or high.

The Medco soil is moderately deep and moderately well drained. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Typically, the surface layer is very dark brown cobbly clay loam about 7 inches thick. The next layer is dark brown cobbly clay loam about 6 inches thick. The subsoil is brown clay about 22 inches thick. Weathered bedrock is at a depth of about 35 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Permeability is very slow in the Medco soil. Available water capacity is about 4 inches. The effective rooting depth is limited by a dense layer of clay at a depth of 6 to 18 inches. Runoff is medium or rapid, and the hazard of water erosion is moderate or high. The water table, which is perched above the layer of clay, is at a depth of 0.5 foot to 1.5 feet from December through March.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include incense cedar, California black oak, and Pacific madrone. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and California fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 95 on the McNull soil. The yield at culmination of the mean annual increment is 4,620 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 37,120 board feet per acre (Scribner rule) at 160 years. On the basis of a 50-year curve, the mean site index is 70.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 85 on the Medco soil. The yield at culmination of the mean annual increment is 4,480 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years and 27,520 board feet per acre (Scribner rule) at 160 years. On the basis of a 50-year curve, the mean site index is 65.

The main limitations affecting timber production are erosion, compaction, plant competition, and seedling mortality. The bedrock in both soils and the dense layer of clay in the Medco soil restrict root growth. As a result, windthrow is a hazard. The Medco soil also is limited by seasonal wetness and slumping.

The perched seasonal high water table in the Medco soil limits the use of equipment to dry periods. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. Using standard wheeled and tracked equipment when the soils are moist causes rutting and compaction. Puddling can occur when the soils are wet. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

The Medco soil is subject to severe slumping. Road failure and landslides are likely to occur after road construction and clearcutting. Slumping can be minimized by constructing logging roads in the less sloping areas, on better suited soils if practical, and by installing properly designed road drainage systems. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate, especially on south- and southwest-facing slopes. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced in the more sloping areas by providing artificial shade for seedlings. The seasonal wetness of the Medco soil increases the seedling mortality rate. Also, seedlings planted in the less fertile clayey subsoil grow poorly.

The main limitations affecting livestock grazing are compaction and erosion on both soils and the seasonal wetness of the Medco soil. The native vegetation suitable for grazing includes Idaho fescue, tall trisetum, and western fescue. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soils. Because the Medco soil remains wet for long periods in spring, grazing should be delayed until the soil is firm and the more desirable forage plants have achieved enough growth to withstand grazing pressure. Compaction can be minimized by grazing first in the areas that dry out earliest.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Pine-Douglas Fir-Fescue.

120B—Medco clay loam, 3 to 7 percent slopes. This moderately deep, moderately well drained soil is on hillslopes. It formed in alluvium and colluvium derived dominantly from andesite, tuff, and breccia. Elevation is 1,500 to 4,000 feet. The mean annual precipitation is 20 to 35 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is very dark brown and very dark grayish brown clay loam about 7 inches thick. The next layer is very dark grayish brown cobbly clay loam about 5 inches thick. The subsoil is brown clay about 18 inches thick. Weathered bedrock is at a depth of about 30 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is cobbly or stony.

Included in this unit are small areas of Carney and McNull soils, McMullin soils and Rock outcrop on ridges and convex slopes, soils that are similar to the Medco soil but are poorly drained and are near drainageways and on concave slopes, and soils that are similar to the Medco soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Medco soils that have slopes of more than 7 percent. Included areas make up about 15 percent of the total acreage.

Permeability is very slow in the Medco soil. Available water capacity is about 4 inches. The effective rooting depth is limited by a dense layer of clay at a depth of 6 to 18 inches. Runoff is slow, and the hazard of water erosion is slight. The water table, which is perched above the layer of clay, is at a depth of 0.5 foot to 1.5 feet from December through March.

This unit is used for hay and pasture, livestock grazing, and wildlife habitat.

This unit is suited to hay and pasture. It is limited mainly by wetness in winter and spring, droughtiness in summer and fall, and the very slow permeability in the subsoil. In summer, irrigation is needed for the maximum production of hay and pasture. Sprinkler irrigation is the best method of applying water. This method permits an even, controlled application of water, helps to prevent excessive runoff, and minimizes the risk of erosion. Border and contour flood irrigation systems also are suitable in the less sloping areas. For the efficient application and removal of surface irrigation water, land leveling is needed; however, deep cuts can expose the bedrock or the clayey subsoil. To prevent overirrigation and excessive erosion or development of a perched water table, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop.

Wetness limits the choice of suitable forage plants and the period of cutting or grazing and increases the risk of winterkill. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth.

The ability of tile drains to remove subsurface water from the soil is limited because of the very slow permeability. Land smoothing and open ditches can reduce surface wetness.

Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

The main limitations affecting livestock grazing are compaction, wetness in winter and spring, and droughtiness in summer and fall. The vegetation suitable for grazing includes California oatgrass, Idaho fescue, and bluegrass. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

Because this soil remains wet for long periods in spring, grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock. Compaction can be minimized by grazing first in the areas that dry out earliest.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment. The use of ground equipment on this unit should be limited to dry periods.

Range seeding is suitable if the site is in poor condition. The main limitations are wetness in winter and spring and droughtiness in summer and fall. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the depth to bedrock.

The vegetative site is Clayey Hills, 20- to 35-inch precipitation zone.

120C—Medco clay loam, 7 to 12 percent slopes. This moderately deep, moderately well drained soil is on hillslopes. It formed in alluvium and colluvium derived dominantly from andesite, tuff, and breccia. Elevation is 1,500 to 4,000 feet. The mean annual precipitation is 20 to 35 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is very dark brown and very dark grayish brown clay loam about 7 inches thick. The next layer is very dark grayish brown cobbly clay loam about 5 inches thick. The subsoil is brown clay about 18 inches thick. Weathered bedrock is at a depth of about 30 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is cobbly or stony.

Included in this unit are small areas of Carney and McNull soils, McMullin soils and Rock outcrop on ridges and convex slopes, poorly drained soils near drainageways and on concave slopes, and soils that are similar to the Medco soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Medco soils that have slopes of less than 7 or more than 12 percent. Included areas make up about 15 percent of the total acreage.

Permeability is very slow in the Medco soil. Available water capacity is about 4 inches. The effective rooting depth is limited by a dense layer of clay at a depth of 6 to 18 inches. Runoff is medium, and the hazard of water erosion is moderate. The water table, which is perched above the layer of clay, is at a depth of 0.5 foot to 1.5 feet from December through March.

This unit is used for hay and pasture, livestock grazing, and wildlife habitat.

This unit is suited to hay and pasture. It is limited mainly by the slope, wetness in winter and spring, droughtiness in summer and fall, and the very slow permeability in the subsoil. In summer, irrigation is needed for the maximum production of hay and pasture. Sprinkler irrigation is the best method of applying water. This method permits an even, controlled application of water, helps to prevent excessive runoff, and minimizes the risk of erosion. To prevent overirrigation and excessive erosion or development of a perched water table, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop.

Wetness limits the choice of suitable forage plants and the period of cutting or grazing and increases the risk of winterkill. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth.

The ability of tile drains to remove subsurface water from the soil is limited because of the very slow permeability and the slope. Wetness can be reduced by interceptor drains.

Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

The main limitations affecting livestock grazing are compaction, wetness in winter and spring, and droughtiness in summer and fall. The vegetation suitable for grazing includes California oatgrass, Idaho fescue, and bluegrass. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

Because this soil remains wet for long periods in spring, grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock. Compaction can be minimized by grazing first in the areas that dry out earliest.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment. The use of ground equipment on this unit should be limited to dry periods.

Range seeding is suitable if the site is in poor condition. The main limitations are wetness in winter and spring and droughtiness in summer and fall. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the slope and the depth to bedrock.

The vegetative site is Clayey Hills, 20- to 35-inch precipitation zone.

121E—Medco cobbly clay loam, 12 to 50 percent north slopes. This moderately deep, moderately well drained soil is on hillslopes. It formed in alluvium and colluvium derived dominantly from andesite, tuff, and breccia. Elevation is 1,500 to 4,000 feet. The mean annual precipitation is 20 to 35 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is very dark brown and very dark grayish brown cobbly clay loam about 7 inches thick. The next layer is very dark grayish brown cobbly clay loam about 5 inches thick. The subsoil is brown clay about 18 inches thick. Weathered bedrock is at a depth of about 30 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Included in this unit are small areas of Carney and McNull soils, McMullin soils and Rock outcrop on ridges and convex slopes, poorly drained soils near drainageways and on concave slopes, and soils that are similar to the Medco soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Medco soils that have slopes of less than 12 or more than 50 percent. Included areas make up about 15 percent of the total acreage.

Permeability is very slow in the Medco soil. Available water capacity is about 4 inches. The effective rooting depth is limited by a dense layer of clay at a depth of 6 to 18 inches. Runoff is medium or rapid, and the hazard of water erosion is moderate or high. The water table, which is perched above the layer of clay, is at a depth of 0.5 foot to 1.5 feet from December through March.

This unit is used mainly for livestock grazing or wildlife habitat. The less sloping parts of a few areas are used for pasture.

The main limitations affecting livestock grazing are compaction, erosion, wetness in winter and spring, droughtiness in summer and fall, the cobbly surface layer, and the slope. The vegetation suitable for grazing includes California oatgrass, Idaho fescue, and bluegrass. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

Because this soil remains wet for long periods in spring, grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock. Compaction can be minimized by grazing first in the areas that dry out earliest.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment. In some areas the use of ground equipment and access by livestock are limited by the seasonal wetness, the cobbles on the surface, and the slope.

Range seeding is suitable if the site is in poor condition. The main limitations are the cobbly surface layer, wetness in winter and spring, and droughtiness in summer and fall. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the slope and the depth to bedrock.

The vegetative site is Clayey Hills, 20- to 35-inch precipitation zone.

122E—Medco cobbly clay loam, 12 to 50 percent south slopes. This moderately deep, moderately well drained soil is on hillslopes. It formed in alluvium and colluvium derived dominantly from andesite, tuff, and breccia. Elevation is 1,500 to 4,000 feet. The mean annual precipitation is 20 to 35 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is very dark brown and very dark grayish brown cobbly clay loam about 7 inches thick. The next layer is very dark grayish brown cobbly clay loam about 5 inches thick. The subsoil is brown clay about 18 inches thick. Weathered bedrock is at a depth of about 30 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Included in this unit are small areas of Carney and McNull soils, McMullin soils and Rock outcrop on ridges and convex slopes, poorly drained soils near drainageways and on concave slopes, and soils that are similar to the Medco soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Medco soils that have slopes of less than 12 or more than 50 percent. Included areas make up about 15 percent of the total acreage.

Permeability is very slow in the Medco soil. Available water capacity is about 4 inches. The effective rooting depth is limited by a dense layer of clay at a depth of 6 to 18 inches. Runoff is medium or rapid, and the hazard of water erosion is moderate or high. The water table, which is perched above the layer of clay, is at a depth of 0.5 foot to 1.5 feet from December through March.

This unit is used mainly for livestock grazing or wildlife habitat. Some of the less sloping areas are used for pasture.

The main limitations affecting livestock grazing are compaction, erosion, wetness in winter and spring, the cobbly surface layer, and the slope. The vegetation suitable for grazing includes bluebunch wheatgrass, Idaho fescue, and pine bluegrass. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

Because this soil remains wet for long periods in spring, grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock. Compaction can be minimized by grazing first in the areas that dry out earliest.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment. In places the use of ground equipment and access by livestock are limited by the seasonal wetness, the cobbles on the surface, and the slope. Constructing trails or walkways allows livestock to graze in areas where access is limited.

Range seeding is suitable if the site is in poor condition. The main limitations are the cobbly surface layer, wetness in winter and spring, and droughtiness in summer and fall. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the slope and the depth to bedrock.

The vegetative site is Loamy Hills, 20- to 35-inch precipitation zone.

123F—Medco clay loam, high precipitation, 12 to 50 percent north slopes. This moderately deep, moderately well drained soil is on hillslopes. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Elevation is 2,500 to 4,000 feet. The mean annual precipitation is 35 to 40 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 150 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is very dark brown clay loam about 7 inches thick. The next layer is dark brown cobbly clay loam about 6 inches thick. The subsoil is brown clay about 22 inches thick. Weathered bedrock is at a depth of about 35 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Included in this unit are small areas of McMullin soils on ridges and convex slopes, poorly drained soils near drainageways, and McNull soils on convex slopes. Also included are small areas of soils that are similar to the Medco soil but have bedrock at a depth of more than 40 inches or are 18 to 30 inches deep to a dense layer of clay and Medco soils that have slopes of less than 12 or more than 50 percent. Included areas make up about 20 percent of the total acreage.

Permeability is very slow in the Medco soil. Available water capacity is about 4 inches. The effective rooting depth is limited by a dense layer of clay at a depth of 6 to 18 inches. Runoff is medium or rapid, and the hazard of water erosion is moderate or high. The water table, which is perched above the layer of clay, is at a depth of 0.5 foot to 1.5 feet from December through March.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include incense cedar, California black oak, and Pacific madrone. The understory vegetation includes creambush oceanspray, common snowberry, and tall Oregon grape.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 85. The yield at culmination of the mean annual increment is 4,480 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years and 27,520 board feet per acre (Scribner rule) at 160 years. On the basis of a 50-year curve, the mean site index is 65.

The main limitations affecting timber production are erosion, compaction, slumping, the seasonal wetness, and plant competition. Also, the dense layer of clay restricts root growth. As a result, windthrow is a hazard.

The perched seasonal high water table limits the use of equipment to dry periods. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both.

This unit is subject to severe slumping. Road failure and landslides are likely to occur after road construction and clearcutting. Slumping can be minimized by constructing logging roads in the less sloping areas, on better suited soils if practical, and by installing properly designed road drainage systems. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants. The seasonal wetness increases the seedling mortality rate. Also, seedlings planted in the less fertile clayey subsoil grow poorly.

The main limitations affecting livestock grazing are compaction, erosion, and the seasonal wetness. The native vegetation suitable for grazing includes western fescue, mountain brome, and tall trisetum. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Because the soil remains wet for long periods in spring, grazing should be delayed until the soil is firm and the more desirable forage plants have achieved enough growth to withstand grazing pressure. Compaction can be minimized by grazing first in the areas that dry out earliest.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Douglas Fir Forest.

124F—Medco clay loam, high precipitation, 12 to 50 percent south slopes. This moderately deep, moderately well drained soil is on hillslopes. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Elevation is 2,500 to 4,000 feet. The mean annual precipitation is 35 to 40 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 150 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is very dark brown clay loam about 7 inches thick. The next layer is dark brown cobbly clay loam about 6 inches thick. The subsoil is brown clay about 22 inches thick. Weathered bedrock is at a depth of about 35 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Included in this unit are small areas of McMullin soils on ridges and convex slopes, poorly drained soils near drainageways, and McNull soils on convex slopes. Also included are small areas of soils that are similar to the Medco soil but have bedrock at a depth of more than 40 inches or are 18 to 30 inches deep to a dense layer of clay and Medco soils that have slopes of less than 12 or more than 50 percent. Included areas make up about 20 percent of the total acreage.

Permeability is very slow in the Medco soil. Available water capacity is about 4 inches. The effective rooting depth is limited by a dense layer of clay at a depth of 6 to 18 inches. Runoff is medium or rapid, and the hazard of water erosion is moderate or high. The water table, which is perched above the layer of clay, is at a depth of 0.5 foot to 1.5 feet from December through March.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include incense cedar, California black oak, and Pacific madrone. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and California fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 85. The yield at culmination of the mean annual increment is 4,480 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years and 27,520 board feet per acre (Scribner rule) at 160 years. On the basis of a 50-year curve, the mean site index is 65.

The main limitations affecting timber production are erosion, compaction, slumping, the seasonal wetness, plant competition, and seedling mortality. Also, the dense layer of clay restricts root growth. As a result, windthrow is a hazard.

The perched seasonal high water table limits the use of equipment to dry periods. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both.

This unit is subject to severe slumping. Road failure and landslides are likely to occur after road construction and clearcutting. Slumping can be minimized by constructing logging roads in the less sloping areas, on better suited soils if practical, and by installing properly designed road drainage systems. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced by providing artificial shade for seedlings. The seasonal wetness increases the seedling mortality rate. Also, seedlings planted in the less fertile clayey subsoil grow poorly.

The main limitations affecting livestock grazing are compaction, erosion, and the seasonal wetness. The native vegetation suitable for grazing includes Idaho fescue, tall trisetum, and western fescue. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Because the soil remains wet for long periods in spring, grazing should be delayed until the soil is firm and the more desirable forage plants have achieved enough growth to withstand grazing pressure. Compaction can be minimized by grazing first in the areas that dry out earliest.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Pine-Douglas Fir-Fescue.

125C—Medco-McMullin complex, 1 to 12 percent slopes. This map unit is on hillslopes. Elevation is 1,300 to 4,000 feet. The mean annual precipitation is 20 to 35 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation on the Medco soil is mainly hardwoods and an understory of grasses, shrubs, and forbs. That on the McMullin soil is mainly grasses, shrubs, and forbs.

This unit is about 55 percent Medco soil and 30 percent McMullin soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Carney and McNull soils, Rock outcrop on ridges and convex slopes, and soils that are similar to the McMullin soil but have more than 35 percent rock fragments or have bedrock at a depth of less than 12 or more than 20 inches. Also included are small areas of soils that are similar to the Medco soil but have bedrock at a depth of more than 40 inches, poorly drained soils near drainageways and on concave slopes, and Medco and McMullin soils that have slopes of more than 12 percent. Included areas make up about 15 percent of the total acreage.

The Medco soil is moderately deep and moderately well drained. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Typically, the surface layer is very dark brown and very dark grayish brown cobbly clay loam about 7 inches thick. The next layer is very dark grayish brown cobbly clay loam about 5 inches thick. The subsoil is brown clay about 18 inches thick. Weathered bedrock is at a depth of about 30 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Permeability is very slow in the Medco soil. Available water capacity is about 4 inches. The effective rooting depth is limited by a dense layer of clay at a depth of 6 to 18 inches. Runoff is slow, and the hazard of water erosion is slight. The water table, which is perched above the layer of clay, is at a depth of 0.5 foot to 1.5 feet from December through March.

The McMullin soil is shallow and well drained. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Typically, the surface layer is dark reddish brown gravelly loam about 7 inches thick. The subsoil is dark reddish brown gravelly clay loam about 10 inches thick. Bedrock is at a depth of about 17 inches. The depth to bedrock ranges from 12 to 20 inches. In some areas the surface layer is stony.

Permeability is moderate in the McMullin soil. Available water capacity is about 2 inches. The effective rooting depth is 12 to 20 inches. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for livestock grazing and wildlife habitat. The main limitations affecting livestock grazing on the Medco soil are compaction, cobbles and stones on the surface, and wetness in winter and spring. The main limitations in areas of the McMullin soil are compaction, the depth to bedrock, cobbles and stones on the surface, and droughtiness. The vegetation suitable for grazing includes California oatgrass, Idaho fescue, and bluegrass on the Medco soil and bluebunch wheatgrass and pine bluegrass on the McMullin soil. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

Because the Medco soil remains wet for long periods in spring, grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock. Compaction can be minimized by grazing first in the areas that dry out earliest.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment. In places the use of ground equipment is limited by the seasonal wetness and the included areas of stony soils and Rock outcrop.

Range seeding is suitable on the Medco soil if the site is in poor condition. The main limitations are the cobbly surface layer, wetness in winter and spring, and droughtiness in summer and fall. The suitability of the McMullin soil for seeding is poor. The main limitations are the depth to bedrock and droughtiness. The included areas of stony soils and Rock outcrop also are limitations. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the slope and the depth to bedrock.

The vegetative site in areas of the Medco soil is Clayey Hills, 20- to 35-inch precipitation zone, and the one in areas of the McMullin soil is Loamy Shrub Scabland, 18- to 35-inch precipitation zone.

125F—Medco-McMullin complex, 12 to 50 percent slopes. This map unit is on hillslopes. Elevation is 1,300 to 4,000 feet. The mean annual precipitation is 20 to 35 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation on the Medco soil is mainly hardwoods and an understory of grasses, shrubs, and forbs. That on the McMullin soil is mainly grasses, shrubs, and forbs.

This unit is about 50 percent Medco soil and 30 percent McMullin soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Carney and McNull soils, Rock outcrop on ridges and convex slopes, and soils that are similar to the McMullin soil but have more than 35 percent rock fragments or have bedrock at a depth of less than 12 or more than 20 inches. Also included are small areas of soils that are similar to the Medco soil but have bedrock at a depth of more than 40 inches, poorly drained soils near drainageways and on concave slopes, and Medco and McMullin soils that have slopes of less than 12 or more than 50 percent. Included areas make up about 20 percent of the total acreage.

The Medco soil is moderately deep and moderately well drained. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Typically, the surface layer is very dark brown and very dark grayish brown cobbly clay loam about 7 inches thick. The next layer is very dark grayish brown cobbly clay loam about 5 inches thick. The subsoil is brown clay about 18 inches thick. Weathered bedrock is at a depth of about 30 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Permeability is very slow in the Medco soil. Available water capacity is about 4 inches. The effective rooting depth is limited by a dense layer of clay at a depth of 6 to 18 inches. Runoff is medium or rapid, and the hazard of water erosion is moderate or high. The water table, which is perched above the layer of clay, is at a depth of 0.5 foot to 1.5 feet from December through March.

The McMullin soil is shallow and well drained. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Typically, the surface layer is dark reddish brown gravelly loam about 7 inches thick. The subsoil is dark reddish brown gravelly clay loam about 10 inches thick. Bedrock is at a depth of about 17 inches. The depth to bedrock ranges from 12 to 20 inches. In some areas the surface layer is stony.

Permeability is moderate in the McMullin soil. Available water capacity is about 2 inches. The effective rooting depth is 12 to 20 inches. Runoff is medium or rapid, and the hazard of water erosion is moderate or high.

This unit is used for livestock grazing and wildlife habitat. The main limitations affecting livestock grazing on the Medco soil are compaction, erosion, cobbles and stones on the surface, wetness in winter and spring, droughtiness in summer and fall, and the slope. The main limitations in areas of the McMullin soil are compaction, erosion, cobbles and stones on the surface, the depth to bedrock, droughtiness, and the slope. The vegetation suitable for grazing includes Idaho fescue, bluebunch wheatgrass, and pine bluegrass. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

Because the Medco soil remains wet for long periods in spring, grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock. Compaction can be minimized by grazing first in the areas that dry out earliest.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment. In places the use of ground equipment is limited by the seasonal wetness, the slope, and the included stony soils and Rock outcrop.

Range seeding is suitable on the Medco soil if the site is in poor condition. The main limitations are the cobbly surface layer, wetness in winter and spring, and droughtiness in summer and fall. The suitability of the McMullin soil for seeding is poor. The main limitations are the depth to bedrock and droughtiness. The included areas of stony soils and Rock outcrop also are limitations. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the slope and the depth to bedrock.

The vegetative site in areas of the Medco soil is Loamy Hills, 20- to 35-inch precipitation zone, and the one in areas of the McMullin soil is Loamy Shrub Scabland, 18- to 35-inch precipitation zone.

126F—Medco-McNull complex, 12 to 50 percent slopes. This map unit is on hillslopes. Elevation is 1,500 to 4,000 feet. The mean annual precipitation is 20 to 35 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation on the Medco soil is mainly hardwoods and an understory of grasses, shrubs, and forbs. That on the McNull soil is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 55 percent Medco soil and 30 percent McNull soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of McMullin soils on ridges and convex slopes, poorly drained soils near drainageways, soils that are similar to the McNull and Medco soils but have bedrock at a depth of more than 40 inches, and soils that are similar to the Medco soil but are 18 to 30 inches deep to a dense layer of clay. Also included are small areas of McNull and Medco soils that have slopes of less than 12 or more than 50 percent. Included areas make up about 15 percent of the total acreage.

The Medco soil is moderately deep and moderately well drained. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Typically, the surface layer is very dark brown and very dark grayish brown cobbly clay loam about 7 inches thick. The next layer is very dark grayish brown cobbly clay loam about 5 inches thick. The subsoil is brown clay about 18 inches thick. Weathered bedrock is at a depth of about 30 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Permeability is very slow in the Medco soil. Available water capacity is about 4 inches. The effective rooting depth is limited by a dense layer of clay at a depth of 6 to 18 inches. Runoff is medium or rapid, and the hazard of water erosion is moderate or high. The water table, which is perched above the layer of clay, is at a depth of 0.5 foot to 1.5 feet from December through March.

The McNull soil is moderately deep and well drained. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is dark reddish brown loam about 6 inches thick. The upper 6 inches of the subsoil is dark reddish brown clay loam. The lower 20 inches is dark reddish brown cobbly clay. Weathered bedrock is at a depth of about 32 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony or cobbly.

Permeability is slow in the McNull soil. Available water capacity is about 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used mainly for livestock grazing or wildlife habitat. The McNull soil also is used for timber production.

The main limitations affecting livestock grazing are compaction, erosion, and the slope. The Medco soil also is limited by wetness in winter and spring. The vegetation suitable for grazing includes Idaho fescue, bluebunch wheatgrass, and pine bluegrass on the Medco soil and Idaho fescue, tall trisetum, and western fescue on the McNull soil. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soils. Because the Medco soil remains wet for long periods in spring, grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock. Compaction can be minimized by grazing first in the areas that dry out earliest.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. In places the use of ground equipment is limited by the seasonal wetness, the slope, and the included areas of stony soils and Rock outcrop.

Range seeding is suitable on the Medco soil if the site is in poor condition. The main limitations are wetness in winter and spring and droughtiness in summer and fall. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The McNull soil is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include incense cedar, California black oak, and Pacific madrone. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and California fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 95 on the McNull soil. The yield at culmination of the mean annual increment is 4,620 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 37,120 board feet per acre (Scribner rule) at 160 years. On the basis of a 50-year curve, the mean site index is 70.

The main limitations affecting timber production on the McNull soil are erosion, compaction, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

The Medco soil, which occurs throughout the unit, is subject to severe slumping. Road failure and landslides are likely to occur after road construction and clearcutting. Slumping can be minimized by constructing logging roads in the less sloping areas, on better suited soils if practical, and by installing properly designed road drainage systems.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate, especially on south- and southwest-facing slopes. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

The vegetative site in areas of the Medco soil is Loamy Hills, 20- to 35-inch precipitation zone, and the one in areas of the McNull soil is Pine-Douglas Fir-Fescue.

127A—Medford silty clay loam, 0 to 3 percent slopes. This very deep, moderately well drained soil is on stream terraces. It formed in alluvium derived dominantly from metamorphic rock. Elevation is 1,000 to 4,000 feet. The mean annual precipitation is 18 to 35 inches, the mean annual temperature is 50 to 54 degrees F, and the average frost-free period is 125 to 180 days. The vegetation in areas that have not been cultivated is mainly grasses and forbs.

Typically, the surface layer is very dark brown silty clay loam about 12 inches thick. The upper 10 inches of the subsoil is very dark brown silty clay. The next 31 inches is dark brown and dark yellowish brown silty clay loam and clay loam. The lower part to a depth of 71 inches is dark yellowish brown sandy clay loam. In some areas the surface layer is gravelly or cobbly.

Included in this unit are small areas of Abin, Evans, Newberg, and Camas soils on flood plains; Gregory soils on the lower terraces and on concave slopes; Coleman soils on the higher terraces; and Central Point soils. Also included are small areas of Medford soils that have slopes of more than 3 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderately slow in the Medford soil. Available water capacity is about 10 inches. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The water table fluctuates between depths of 4 and 6 feet from December through April.

This unit is used mainly for irrigated crops, such as alfalfa hay, tree fruit, and small grain. Other crops include corn for silage and sugar beet seed. Some areas are used for homesite development, grass-legume hay, or pasture.

This unit is well suited to irrigated crops. It is limited mainly by the moderately slow permeability and wetness in winter and spring. In summer, irrigation is needed for the maximum production of most crops. Furrow, border, corrugation, trickle, and sprinkler irrigation systems are suitable. The system used generally is governed by the crop that is grown. For the efficient application and removal of surface irrigation water, land leveling is needed. To prevent overirrigation and excessive erosion, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. The use of pipe, ditch lining, or drop structures in irrigation ditches reduces water loss and the hazard of erosion.

A subsurface drainage system can lower the water table if a suitable outlet is available. Land smoothing and open ditches can reduce surface wetness.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Leaving crop residue on or near the surface helps to conserve moisture and control erosion.

A tillage pan forms easily if the soil is tilled when wet. Chiseling or subsoiling breaks up the pan. Surface crusting and compaction can be minimized by returning crop residue to the soil.

Solid-set sprinkler irrigation is the best method of controlling frost and providing adequate moisture for tree fruit. Compaction can be minimized by limiting the use of equipment when the soil is wet. A permanent cover crop helps to control runoff and erosion.

Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes.

Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

The main limitations affecting homesite development are the moderately slow permeability, the wetness, the shrink-swell potential, and low strength.

The moderately slow permeability and depth to the water table increase the possibility that septic tank absorption fields will fail. The moderately slow permeability can be overcome by increasing the size of the absorption field. Interceptor ditches can divert subsurface water and thus improve the efficiency of the absorption fields.

A drainage system may be needed if roads and building foundations are constructed on this unit. The wetness can be reduced by installing drainage tile around footings. Properly designing foundations and footings, diverting runoff away from the buildings, and backfilling with material that has a low shrink-swell potential help to prevent the structural damage caused by shrinking and swelling. Properly designing buildings and roads helps to offset the limited ability of the soil to support a load.

Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

The vegetative site is Deep Loamy Terrace, 18- to 28-inch precipitation zone.

128B—Medford clay loam, gravelly substratum, 0 to 7 percent slopes. This very deep, moderately well drained soil is on stream terraces. It formed in alluvium derived dominantly from metamorphic rock. Elevation is 1,000 to 4,000 feet. The mean annual precipitation is 18 to 35 inches, the mean annual temperature is 50 to 54 degrees F, and the average frost-free period is 125 to 180 days. The vegetation in areas that have not been cultivated is mainly grasses and forbs.

Typically, the surface layer is very dark gray clay loam about 9 inches thick. The subsoil is very dark grayish brown clay about 31 inches thick. The substratum to a depth of 62 inches is light olive brown very gravelly clay loam. In some areas the surface layer is gravelly or cobbly.

Included in this unit are small areas of Abin, Evans, Newberg, and Camas soils on flood plains; Gregory soils on the lower terraces and on concave slopes; Coleman soils on the higher terraces; and Central Point soils. Also included are small areas of Medford soils that have slopes of more than 7 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately slow in the Medford soil. Available water capacity is about 8 inches. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The water table fluctuates between depths of 3 and 5 feet from December through April.

This unit is used mainly for irrigated crops, such as alfalfa hay, tree fruit, and small grain. Other crops include corn for silage and sugar beet seed. Some areas are used for homesite development, grass-legume hay, or pasture.

This unit is well suited to irrigated crops. It is limited mainly by the moderately slow permeability and wetness in winter and spring. In summer, irrigation is needed for the maximum production of most crops. Furrow, border, corrugation, trickle, and sprinkler irrigation systems are suitable. The system used generally is governed by the crop that is grown. For the efficient application and removal of surface irrigation water, land leveling is needed. To prevent overirrigation and excessive erosion, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. The use of pipe, ditch lining, or drop structures in irrigation ditches reduces water loss and the hazard of erosion.

A subsurface drainage system can lower the water table if a suitable outlet is available. Land smoothing and open ditches can reduce surface wetness.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Leaving crop residue on or near the surface helps to conserve moisture and control erosion.

A tillage pan forms easily if the soil is tilled when wet. Chiseling or subsoiling breaks up the pan. Surface crusting and compaction can be minimized by returning crop residue to the soil.

Solid-set sprinkler irrigation is the best method of controlling frost and providing adequate moisture for tree fruit. Compaction can be minimized by limiting the use of equipment when the soil is wet. A permanent cover crop helps to control runoff and erosion.

Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

The main limitations affecting homesite development are the moderately slow permeability, the wetness, the shrink-swell potential, and low strength.

The moderately slow permeability and depth to the water table increase the possibility that septic tank absorption fields will fail. The moderately slow permeability can be overcome by increasing the size of the absorption field. Interceptor ditches can divert subsurface water and thus improve the efficiency of the absorption fields.

A drainage system may be needed if roads and building foundations are constructed on this unit. The wetness can be reduced by installing drainage tile around footings. Properly designing foundations and footings, diverting runoff away from the buildings, and backfilling with material that has a low shrink-swell potential help to prevent the structural damage caused by shrinking and swelling. Properly designing buildings and roads helps to offset the limited ability of the soil to support a load.

Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

The vegetative site is Deep Loamy Terrace, 18- to 28-inch precipitation zone.

129B—Merlin extremely stony loam, 1 to 8 percent slopes. This shallow, well drained soil is on plateaus. It formed in residuum derived dominantly from andesite and tuff. Elevation is 4,000 to 4,800 feet. The mean annual precipitation is 17 to 18 inches, the mean annual temperature is 43 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly grasses, shrubs, and forbs.

Typically, the surface layer is dark brown extremely stony loam about 11 inches thick. The subsoil is dark brown clay about 2 inches thick. Bedrock is at a depth of about 13 inches. The depth to bedrock ranges from 10 to 20 inches. In some areas the surface layer is very gravelly or very cobbly.

Included in this unit are small areas of Bly and Royst soils and soils that are similar to the Merlin soil but have bedrock within a depth of 10 inches or have a subsoil of loam. Also included are small areas of Merlin soils that have slopes of more than 8 percent. Included areas make up about 20 percent of the total acreage.

Permeability is very slow in the Merlin soil. Available water capacity is about 2 inches. The effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is moderate.

This unit is used for livestock grazing and wildlife habitat. The main limitations affecting livestock grazing are compaction, stones on the surface, droughtiness, and the depth to bedrock. The vegetation suitable for grazing includes Idaho fescue, pine bluegrass, and bluebunch wheatgrass. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment. The use of ground equipment is not practical because of the stones on the surface.

This unit is poorly suited to range seeding. The main limitations are droughtiness, the stones on the surface, and the depth to bedrock. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the depth to bedrock.

The vegetative site is Loamy Juniper Scabland, 20- to 30-inch precipitation zone.

130E—Musty-Goolaway complex, 12 to 35 percent slopes. This map unit is on ridges. Elevation is 2,500 to 4,000 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 60 percent Musty soil and 20 percent Goolaway soil. The Goolaway soil commonly has slopes of more than 20 percent. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Josephine, Siskiyou, and Speaker soils; Pollard soils on concave slopes; Rock outcrop; soils that are similar to the Musty soil but have bedrock within a depth of 20 inches; and soils that are similar to the Goolaway soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Musty and Goolaway soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 20 percent of the total acreage.

The Musty soil is moderately deep and well drained. It formed in colluvium derived dominantly from schist.

Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is very dark grayish brown gravelly loam about 12 inches thick. The subsoil is dark grayish brown very cobbly loam about 17 inches thick. Bedrock is at a depth of about 29 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is very gravelly, very cobbly, or stony.

Permeability is moderate in the Musty soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate or high.

The Goolaway soil is moderately deep and well drained. It formed in colluvium derived dominantly from schist. Typically, the surface is covered with a layer of needles, leaves, and twigs about 2 inches thick. The surface layer is very dark grayish brown silt loam about 3 inches thick. The next layer is dark grayish brown silt loam about 8 inches thick. The subsoil is olive gray and olive silt loam about 18 inches thick. Weathered bedrock is at a depth of about 29 inches. The depth to bedrock ranges from 20 to 40 inches.

Permeability is moderate in the Goolaway soil. Available water capacity is about 6 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate or high.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir. Other species that grow on this unit include ponderosa pine, sugar pine, and incense cedar. The understory vegetation includes golden chinkapin, cascade Oregongrape, and deerfoot vanillaleaf.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 110 on the Musty soil. The yield at culmination of the mean annual increment is 5,880 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 48,300 board feet per acre (Scribner rule) at 140 years. On the basis of a 50-year curve, the mean site index is 80.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 115 on the Goolaway soil. The yield at culmination of the mean annual increment is 6,360 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 45,600 board feet per acre (Scribner rule) at 150 years. On the basis of a 50-year curve, the mean site index is 95.

The main limitations affecting timber production are erosion, compaction, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

When timber is harvested, management that minimizes the risk of erosion is essential. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. If the soils are excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soils are moist causes rutting and compaction. Puddling can occur when the soils are wet. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate on south- and southwest-facing slopes. The large number of rock fragments in the Musty soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced by providing artificial shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

Increased erosion, loss of plant nutrients, and water repellency are likely to result from fires of moderate intensity.

The vegetative site is Douglas Fir-Chinkapin Forest.

131F—Musty-Goolaway complex, 35 to 50 percent north slopes. This map unit is on hillslopes. Elevation is 2,500 to 4,000 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 45 to

50 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 40 percent Musty soil and 35 percent Goolaway soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Josephine, Siskiyou, and Speaker soils; Pollard soils on the less sloping parts of the landscape and on concave slopes; and soils that are similar to the Musty and Goolaway soils but have bedrock at a depth of more than 40 inches. Also included are small areas of and Musty and Goolaway soils that have slopes of less than 35 or more than 50 percent. Included areas make up about 25 percent of the total acreage.

The Musty soil is moderately deep and well drained. It formed in colluvium derived dominantly from schist. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is very dark grayish brown gravelly loam about 12 inches thick. The subsoil is dark grayish brown very cobbly loam about 17 inches thick. Bedrock is at a depth of about 29 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is very gravelly or very cobbly.

Permeability is moderate in the Musty soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

The Goolaway soil is moderately deep and well drained. It formed in colluvium derived dominantly from schist. Typically, the surface is covered with a layer of needles, leaves, and twigs about 2 inches thick. The surface layer is very dark grayish brown silt loam about 3 inches thick. The next layer is dark grayish brown silt loam about 8 inches thick. The subsoil is olive gray and olive silt loam about 18 inches thick. Weathered bedrock is at a depth of about 29 inches. The depth to bedrock ranges from 20 to 40 inches.

Permeability is moderate in the Goolaway soil. Available water capacity is about 6 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir. Other species that grow on this unit include ponderosa pine, incense cedar, and sugar pine. The understory vegetation includes golden chinkapin, cascade Oregongrape, and deerfoot vanillaleaf.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 120 on the Musty soil. The yield at culmination of the mean annual increment is 6,900 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 52,440 board feet per acre (Scribner rule) at 120 years. On the basis of a 50-year curve, the mean site index is 85.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 125 on the Goolaway soil. The yield at culmination of the mean annual increment is 7,320 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 45,600 board feet per acre (Scribner rule) at 150 years. On the basis of a 50-year curve, the mean site index is 95.

The main limitations affecting timber production are the slope, erosion, compaction, plant competition, and seedling mortality. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

When timber is harvested, management that minimizes the risk of erosion is essential. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. If the soils are excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soils are moist causes rutting and compaction. Puddling can occur when the soils are wet. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation.

This unit is subject to slumping. Road failure and landslides are likely to occur after road construction and clearcutting. Slumping can be minimized by constructing logging roads in the less sloping areas, on better suited soils if practical, and by installing properly designed road drainage systems. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

Increased erosion, loss of plant nutrients, and water repellency are likely to result from fires of moderate intensity.

The vegetative site is Douglas Fir-Chinkapin Forest.

132F—Musty-Goolaway complex, 35 to 50 percent south slopes. This map unit is on hillslopes. Elevation is 2,500 to 4,000 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 45 percent Musty soil and 30 percent Goolaway soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Josephine, Siskiyou, and Speaker soils; Pollard soils on the less sloping parts of the landscape and on concave slopes; and soils that are similar to the Musty and Goolaway soils but have bedrock at a depth of more than 40 inches. Also included are small areas of Musty and Goolaway soils that have slopes of less than 35 or more than 50 percent. Included areas make up about 25 percent of the total acreage.

The Musty soil is moderately deep and well drained. It formed in colluvium derived dominantly from schist. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is very dark grayish brown gravelly loam about 12 inches thick. The subsoil is dark grayish brown very cobbly loam about 17 inches thick. Bedrock is at a depth of about 29 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is very gravelly or very cobbly.

Permeability is moderate in the Musty soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

The Goolaway soil is moderately deep and well drained. It formed in colluvium derived dominantly from schist. Typically, the surface is covered with a layer of needles, leaves, and twigs about 2 inches thick. The surface layer is very dark grayish brown silt loam about 3 inches thick. The next layer is dark grayish brown silt loam about 8 inches thick. The subsoil is olive gray and olive silt loam about 18 inches thick. Weathered bedrock is at a depth of about 29 inches. The depth to bedrock ranges from 20 to 40 inches.

Permeability is moderate in the Goolaway soil. Available water capacity is about 6 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir. Other species that grow on this unit include ponderosa pine, sugar pine, and California black oak. The understory vegetation includes canyon live oak, deerbrush, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 110 on the Musty soil. The yield at culmination of the mean annual increment is 5,880 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 48,300 board feet per acre (Scribner rule) at 140 years. On the basis of a 50-year curve, the mean site index is 80.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 115 on the Goolaway soil. The yield at culmination of the mean annual increment is 6,360 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 50,700 board feet per acre (Scribner rule) at 130 years. On the basis of a 50-year curve, the mean site index is 90.

The main limitations affecting timber production are the slope, erosion, compaction, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

When timber is harvested, management that minimizes the risk of erosion is essential. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. If the soils are excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soils are moist causes rutting and compaction. Puddling can occur when the soils are wet. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion.

Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation.

This unit is subject to slumping. Road failure and landslides are likely to occur after road construction and clearcutting. Slumping can be minimized by constructing logging roads in the less sloping areas, on better suited soils if practical, and by installing properly designed road drainage systems. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. The large number of rock fragments in the Musty soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced by providing artificial shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable understory plants.

Increased erosion, loss of plant nutrients, and water repellency are likely to result from fires of moderate intensity.

The vegetative site is Douglas Fir-Black Oak Forest.

133A—Newberg fine sandy loam, 0 to 3 percent slopes. This very deep, somewhat excessively drained soil is on flood plains. It formed in alluvium derived from mixed sources. Elevation is 1,000 to 3,000 feet. The mean annual precipitation is 18 to 40 inches, the mean annual temperature is 50 to 54 degrees F, and the average frost-free period is 150 to 180 days. The vegetation in areas that have not been cultivated is mainly hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is very dark grayish brown fine sandy loam about 17 inches thick. The upper 13 inches of the substratum is dark brown sandy loam. The next 12 inches is dark brown fine sand. The lower part to a depth of 60 inches is dark grayish brown loamy sand. In some areas the surface layer is gravelly or cobbly.

Included in this unit are small areas of Abin, Camas, and Evans soils; Cove soils on concave slopes; Central Point, Medford, Takilma soils on terraces; and soils that are similar to the Newberg soil but have a gravelly or very gravelly substratum. Also included are small areas of Riverwash, poorly drained soils, and Newberg soils that have slopes of more than 3 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately rapid in the upper part of the Newberg soil and rapid in the lower part. Available water capacity is about 8 inches. The effective rooting depth is 60 inches or more. The substratum can restrict the penetration of roots, however, because of droughtiness. Runoff is slow, and the hazard of water erosion is slight. This soil is occasionally flooded for brief periods from December through March.

This unit is used mainly for irrigated crops, such as alfalfa hay and small grain. Other crops include corn for silage. Some areas are used for grass-legume hay, pasture, or homesite development.

This unit is suited to irrigated crops. It is limited mainly by the hazard of flooding. This hazard can be reduced by levees, dikes, and diversions.

In summer, irrigation is needed for the maximum production of most crops. Furrow, border, corrugation, trickle, and sprinkler irrigation systems are suitable. The system used generally is governed by the crop that is grown. For the efficient application and removal of surface irrigation water, leveling is needed in the more sloping areas. To prevent overirrigation and the leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. Because the soil is droughty, the applications should be light and frequent. The use of pipe, ditch lining, or drop structures in irrigation ditches facilitates irrigation and reduces the hazard of ditch erosion.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Leaving crop residue on or near the surface helps to conserve moisture and control erosion.

A tillage pan forms easily if the soil is tilled when wet. Chiseling or subsoiling breaks up the pan. Surface crusting and compaction can be minimized by returning crop residue to the soil.

Maintaining a protective plant cover in winter reduces the soil loss resulting from flooding. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

The main limitations affecting homesite development are the flooding and the rapid permeability in the substratum.

This unit is poorly suited to standard systems of waste disposal because of a poor filtering capacity in the substratum and the hazard of flooding. Alternative waste disposal systems may function properly on this unit. Suitable included soils are throughout the unit. Onsite investigation is needed to locate such soils. Dikes and channels that have outlets for floodwater can protect buildings and onsite sewage disposal systems from flooding.

In some areas excavation for houses and access roads exposes material that is highly susceptible to soil blowing. Revegetating as soon as possible in disturbed areas around construction sites helps to control soil blowing. Cutbanks are not stable and are subject to slumping. To keep cutbanks from caving in, excavations may require special retainer walls.

Establishing plants is difficult in areas where the surface layer has been removed. Mulching and applying fertilizer help to establish plants in cut areas. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. In many areas it may be necessary to haul in topsoil for lawns and gardens. Because of droughtiness and a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

Roads and streets should be constructed above the expected level of flooding. The risk of flooding has been reduced in some areas by the construction of large dams and reservoirs upstream.

The vegetative site is Loamy Flood Plain, 18- to 30-inch precipitation zone.

134F—Norling-Acker complex, 35 to 55 percent south slopes. This map unit is on hillslopes. Elevation is 2,400 to 4,000 feet. The mean annual precipitation is 45 to 60 inches, the mean annual temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 45 percent Norling soil and 35 percent Acker soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Dubakella, Gravecreek, and Pearsoll soils; Dumont soils on the less sloping parts of the landscape and on concave slopes; and Atring and Kanid soils on the more sloping parts of the landscape and on convex slopes. Also included are small areas of Acker and Norling soils that have slopes of less than 35 or more than 55 percent. Included areas make up about 20 percent of the total acreage.

The Norling soil is moderately deep and well drained. It formed in colluvium derived dominantly from metamorphic rock. Typically, the surface is covered with a layer of needles, leaves, and twigs about 2 inches thick. The surface layer is brown very gravelly loam about 5 inches thick. The next layer is brown gravelly clay loam about 5 inches thick. The upper 12 inches of the subsoil is yellowish brown gravelly clay loam. The lower 7 inches is yellowish brown very cobbly clay loam. Weathered bedrock is at a depth of about 29 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Permeability is moderate in the Norling soil. Available water capacity is about 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

The Acker soil is very deep and well drained. It formed in colluvium derived dominantly from metamorphic rock. Typically, the surface is covered with a layer of needles, leaves, and twigs about 4 inches thick. The surface layer is brown gravelly loam about 8 inches thick. The next layer is yellowish brown gravelly clay loam about 9 inches thick. The upper 11 inches of the subsoil is yellowish red gravelly clay loam. The lower 32 inches is strong brown gravelly clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is stony.

Permeability is moderately slow in the Acker soil. Available water capacity is about 7 inches. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir. Other species that grow on this unit include incense cedar, sugar pine, and Pacific madrone. The understory vegetation includes golden chinkapin, Whipplevine, and cascade Oregongrape.

On the basis of a 100-year site curve, the mean site

index for Douglas fir is 125 on the Norling soil. The yield at culmination of the mean annual increment is 7,320 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 58,200 board feet per acre (Scribner rule) at 120 years. On the basis of a 50-year curve, the mean site index is 90.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 130 on the Acker soil. The yield at culmination of the mean annual increment is 7,740 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 58,520 board feet per acre (Scribner rule) at 110 years. On the basis of a 50-year curve, the mean site index is 95.

The main limitations affecting timber production are the slope, erosion, compaction, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. Using standard wheeled and tracked equipment when the soils are moist causes rutting and compaction. Puddling can occur when the soils are wet. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soils are saturated.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced by providing artificial shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

The vegetative site is Douglas Fir-Madrone-Chinkapin Forest.

135E—Oatman cobbly loam, 12 to 35 percent north slopes. This very deep, well drained soil is on hillslopes. It formed in colluvium derived from andesite and volcanic ash. Elevation is 4,800 to 6,500 feet. The mean annual precipitation is 30 to 40 inches, the mean annual temperature is 40 to 44 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles and twigs about 3 inches thick. The surface layer is dark brown cobbly loam about 16 inches thick. The subsoil is dark brown very cobbly sandy loam about 14 inches thick. The substratum to a depth of 60 inches also is dark brown very cobbly sandy loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is very cobbly or stony.

Included in this unit are small areas of Rock outcrop and Rubble land on ridges and convex slopes, Otwin soils on ridges and on the more sloping parts of the landscape, soils that are similar to the Oatman soil but have bedrock at a depth of 40 to 60 inches or have less than 35 percent rock fragments, and poorly drained soils near drainageways and on concave slopes. Also included are small areas of Oatman soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Oatman soil. Available water capacity is about 6 inches. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of white fir and Shasta red fir. Other species that grow on this unit include western white pine, Douglas fir, and ponderosa pine. The understory vegetation includes sierra chinkapin, western princes pine, big huckleberry, and sedge.

On the basis of a 50-year site curve, the mean site

index for white fir is 75. The yield at culmination of the mean annual increment is 12,530 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years.

On the basis of a 100-year site curve, the mean site index for Shasta red fir is 60. The yield at culmination of the mean annual increment is 29,960 cubic feet per acre in a fully stocked, even-aged stand of trees at 140 years.

The main limitations affecting timber production are erosion, compaction, plant competition, and seedling mortality. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting ponderosa pine, Shasta red fir, or lodgepole pine seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

Severe frost can damage or kill seedlings. In the less sloping areas where air drainage may be restricted, proper timber harvesting methods can reduce the effect of frost on regeneration.

The main limitations affecting livestock grazing are compaction and erosion. The native vegetation suitable for grazing includes sedge, mountain brome, tall trisetum, and western fescue. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion. The seedling survival rate may be low, however, because of cold temperatures in spring.

The vegetative site is Shasta Fir-White Pine-Princes Pine Forest.

135G—Oatman cobbly loam, 35 to 65 percent north slopes. This very deep, well drained soil is on hillslopes. It formed in colluvium derived from andesite and volcanic ash. Elevation is 4,800 to 6,500 feet. The mean annual precipitation is 30 to 40 inches, the mean annual temperature is 40 to 44 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles and twigs about 3 inches thick. The surface layer is dark brown cobbly loam about 16 inches thick. The subsoil is dark brown very cobbly sandy loam about 14 inches thick. The substratum to a depth of 60 inches also is dark brown very cobbly sandy loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is very cobbly or stony.

Included in this unit are small areas of Rock outcrop, Rubble land, and Otwin soils on ridges and convex slopes. Also included are small areas of soils that are similar to the Oatman soil but have bedrock at a depth of 40 to 60 inches or have less than 35 percent rock fragments and Oatman soils that have slopes of less than 35 or more than 65 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Oatman soil. Available water capacity is about 6 inches. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of white fir and

Shasta red fir. Other species that grow on this unit include western white pine, Douglas fir, and ponderosa pine. The understory vegetation includes sierra chinkapin, western princes pine, big huckleberry, and sedge.

On the basis of a 50-year site curve, the mean site index for white fir is 75. The yield at culmination of the mean annual increment is 12,530 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years.

On the basis of a 100-year site curve, the mean site index for Shasta red fir is 60. The yield at culmination of the mean annual increment is 29,960 cubic feet per acre in a fully stocked, even-aged stand of trees at 140 years.

The main limitations affecting timber production are the slope, erosion, compaction, plant competition, and seedling mortality. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Building the roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting ponderosa pine, Shasta red fir, or lodgepole pine seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

Severe frost can damage or kill seedlings. Proper timber harvesting methods can reduce the effect of frost on regeneration.

The main limitations affecting livestock grazing are erosion, compaction, and the slope. The native vegetation suitable for grazing includes sedge, mountain brome, tall trisetum, and western fescue. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion. The seedling survival rate may be low, however, because of cold temperatures in spring.

The vegetative site is Shasta Fir-White Pine-Princes Pine Forest.

136E—Oatman cobbly loam, 12 to 35 percent south slopes. This very deep, well drained soil is on hillslopes. It formed in colluvium derived from andesite and volcanic ash. Elevation is 4,800 to 6,500 feet. The mean annual precipitation is 30 to 40 inches, the mean annual temperature is 40 to 44 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles and twigs about 3 inches thick. The surface layer is dark brown cobbly loam about 16 inches thick. The subsoil is dark brown very cobbly sandy loam about 14 inches thick. The substratum to a depth of 60 inches also is dark brown very cobbly sandy loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is very cobbly or stony.

Included in this unit are small areas of Rock outcrop and Rubble land on ridges and convex slopes, Otwin soils on ridges and on the more sloping parts of the landscape, and soils that are similar to the Oatman soil but have bedrock at a depth of 40 to 60 inches or have less than 35 percent rock fragments. Also included are small areas of poorly drained soils near drainageways and on concave slopes and Oatman soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Oatman soil. Available water capacity is about 6 inches. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of white fir and Shasta red fir. Other species that grow on this unit include western white pine, Douglas fir, and ponderosa pine. The understory vegetation includes sierra chinkapin, western princes pine, and sedge.

On the basis of a 50-year site curve, the mean site index for white fir is 75. The yield at culmination of the mean annual increment is 12,530 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years.

On the basis of a 100-year site curve, the mean site index for Shasta red fir is 55. The yield at culmination of the mean annual increment is 26,880 cubic feet per acre in a fully stocked, even-aged stand of trees at 140 years.

The main limitations affecting timber production are erosion, compaction, seedling mortality, and plant competition. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. The large number of rock fragments in the soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. Reforestation can be accomplished by planting ponderosa pine seedlings.

Severe frost can damage or kill seedlings. In the less sloping areas where air drainage may be restricted, proper timber harvesting methods can reduce the effect of frost on regeneration.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

The main limitations affecting livestock grazing are erosion, compaction, and the slope. The native vegetation suitable for grazing includes sedge, mountain brome, Alaska oniongrass, and western fescue. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion. The seedling survival rate may be low, however, because of cold temperatures in spring.

The vegetative site is White Fir-Shasta Fir Forest.

137C—Oatman cobbly loam, depressional, 0 to 12 percent slopes. This very deep, well drained soil is on plateaus. It formed in colluvium and residuum derived from andesite and volcanic ash. Elevation is 4,900 to

5,200 feet. The mean annual precipitation is 30 to 40 inches, the mean annual temperature is 40 to 44 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles and twigs about 3 inches thick. The surface layer is dark brown cobbly loam about 16 inches thick. The subsoil is dark brown very cobbly sandy loam about 14 inches thick. The substratum to a depth of 60 inches also is dark brown very cobbly sandy loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is very cobbly or stony.

Included in this unit are small areas of Rock outcrop, Otwin and Hoxie soils, and soils that are similar to the Oatman soil but have bedrock at a depth of 40 to 60 inches or have less than 35 percent rock fragments. Also included are small areas of Oatman soils that have slopes of more than 12 percent. Included areas make up about 10 percent of the total acreage.

Permeability is moderate in the Oatman soil. Available water capacity is about 6 inches. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of white fir and lodgepole pine. Other species that grow on this unit include ponderosa pine, western white pine, and Douglas fir. The understory vegetation includes onesided wintergreen, western princes pine, and sedge.

On the basis of a 50-year site curve, the mean site index for white fir is 70. The yield at culmination of the mean annual increment is 11,410 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years.

The main limitations affecting timber production are compaction, erosion, seedling mortality, and plant competition. Conventional methods of harvesting timber generally are suitable, but the soil may be compacted if it is moist when heavy equipment is used. Puddling can occur when the soil is wet. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Erosion can be controlled by carefully planning the construction and maintenance of logging roads, skid trails, and landings. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Severe frost can damage or kill seedlings. Air drainage is restricted on this unit. Proper timber harvesting methods can reduce the effect of frost on regeneration. Reforestation can be accomplished by planting seedlings of frost-tolerant species, such as ponderosa pine, Shasta red fir, and lodgepole pine.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

The main limitation affecting livestock grazing is compaction. The native vegetation suitable for grazing includes sedge, mountain brome, western fescue, and tall trisetum. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion. The seedling survival rate may be low, however, because of cold temperatures in spring.

The vegetative site is White Fir-White Pine Forest.

138C—Oatman-Otwin complex, 0 to 12 percent slopes. This map unit is on plateaus. Elevation is 4,800 to 6,500 feet. The mean annual precipitation is 30 to 40 inches, the mean annual temperature is 40 to 44 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

This unit is about 70 percent Oatman soil and 20 percent Otwin soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Rock outcrop, Klamath soils near drainageways and on concave slopes, soils that are similar to the Otwin soil but have bedrock at a depth of 40 to 60 inches, and soils that are similar to the Oatman soil but have less than 35 percent rock fragments. Also included are small areas of Oatman and Otwin soils that have slopes of more than 12 percent. Included areas make up about 10 percent of the total acreage.

The Oatman soil is very deep and well drained. It formed in colluvium and residuum derived dominantly from andesite and volcanic ash. Typically, the surface is covered with a layer of needles and twigs about 3 inches thick. The surface layer is dark brown cobbly loam about 16 inches thick. The subsoil is dark brown very cobbly sandy loam about 14 inches thick. The substratum to a depth of 60 inches also is dark brown very cobbly sandy loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is very cobbly or stony.

Permeability is moderate in the Oatman soil. Available water capacity is about 6 inches. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

The Otwin soil is moderately deep and well drained. It formed in colluvium and residuum derived dominantly from andesite and volcanic ash. Typically, the surface is covered with a layer of needles and twigs about 1 inch thick. The surface layer is very dark grayish brown stony sandy loam about 3 inches thick. The next layer is dark yellowish brown very cobbly sandy loam about 10 inches thick. The subsoil is dark brown very cobbly sandy loam about 15 inches thick. Bedrock is at a depth of about 28 inches. The depth to bedrock ranges from 20 to 40 inches.

Permeability is moderately rapid in the Otwin soil. Available water capacity is about 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of white fir and Shasta red fir. Other species that grow on this unit include western white pine, Douglas fir, and ponderosa pine. The understory vegetation includes sierra chinkapin, western princes pine, big huckleberry, and sedge.

On the basis of a 50-year site curve, the mean site index for white fir is 75 on the Oatman soil. The yield at culmination of the mean annual increment is 12,530 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years.

On the basis of a 100-year site curve, the mean site index for Shasta red fir is 50 on the Oatman soil. The yield at culmination of the mean annual increment is 23,940 cubic feet per acre in a fully stocked, even-aged stand of trees at 140 years.

On the basis of a 50-year site curve, the mean site index for white fir is 65 on the Otwin soil. The yield at culmination of the mean annual increment is 10,150 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years.

On the basis of a 100-year site curve, the mean site index for Shasta red fir is 40 on the Otwin soil. The yield at culmination of the mean annual increment is 18,900 cubic feet per acre in a fully stocked, even-aged stand of trees at 140 years.

The main limitations affecting timber production are compaction, erosion, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Conventional methods of harvesting timber generally are suitable, but the soils may be compacted if they are moist when heavy equipment is used. Puddling can occur when the soils are wet. If the soils are excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Erosion can be controlled by carefully planning the construction and maintenance of logging roads, skid trails, and landings. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Severe frost can damage or kill seedlings. Air drainage is restricted on this unit. Proper timber harvesting methods can reduce the effect of frost on regeneration. Reforestation can be accomplished by planting seedlings of frost-tolerant species, such as ponderosa pine, Shasta red fir, and lodgepole pine.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

The main limitation affecting livestock grazing is compaction. The native vegetation suitable for grazing includes sedge, mountain brome, tall trisetum, and western fescue. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soils. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion. The seedling survival rate may be low, however, because of cold temperatures in spring.

The vegetative site is Shasta Fir-White Pine-Princes Pine Forest.

139A—Padigan clay, 0 to 3 percent slopes. This very deep, poorly drained soil is in basins. It formed in alluvium derived dominantly from tuff and breccia. Elevation is 1,200 to 3,500 feet. The mean annual precipitation is 18 to 30 inches, the mean annual temperature is 46 to 54 degrees F, and the average frost-free period is 120 to 180 days. The native vegetation is mainly grasses, sedges, and forbs.

Typically, the surface layer is very dark gray clay about 12 inches thick. The next layer is very dark gray and very dark grayish brown, calcareous clay about 24 inches thick. The subsoil to a depth of 60 inches is grayish brown, calcareous clay and gravelly sandy clay loam. The depth to bedrock is 60 inches or more.

Included in this unit are small areas of Carney and Darow soils on convex slopes; Cove and Gregory soils near drainageways; Coker, Medford, and Phoenix soils; and soils that are similar to the Padigan soil but have bedrock at a depth of 40 to 60 inches. Also included are small areas of Padigan soils that have slopes of more than 3 percent. Included areas make up about 20 percent of the total acreage.

Permeability is very slow in the Padigan soil. Available water capacity is about 8 inches. The effective rooting depth is limited by the water table, which is 1.0 foot above to 0.5 foot below the surface from November through May. Runoff is ponded, and the hazard of water erosion is slight.

This unit is used mainly for pasture. It also is used for tree fruit, hay, and homesite development.

This unit is suited to permanent pasture. It is limited mainly by the wetness, the high content of clay, and a slow rate of water intake. Crops that require good drainage can be grown if a properly designed drainage system is installed. The ability of tile drains to remove subsurface water from the soil is limited because of the very slow permeability.

In summer, irrigation is needed for the maximum production of most forage crops. Sprinkler irrigation is the best method of applying water. Border and contour flood irrigation systems also are suitable. For the efficient application and removal of surface irrigation water, land leveling is needed. Because of the very slow permeability and the water table, water applications should be regulated so that the water does not stand on the surface and damage the crop. Land smoothing and open ditches can reduce surface wetness. The use of pipe, ditch lining, or drop structures in irrigation ditches reduces water loss and the hazard of erosion.

Wetness limits the choice of suitable forage plants and the period of cutting or grazing and increases the risk of winterkill. The high content of clay severely limits tillage and root growth. Deep cracks form as the soil dries in summer. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

Solid-set sprinkler irrigation is the best method of controlling frost and providing adequate moisture for tree fruit. Compaction can be minimized by limiting the use of equipment when the soil is wet. A permanent cover crop helps to control runoff and erosion.

This unit is poorly suited to homesite development. The main limitations are the wetness, a high shrink-swell potential, the very slow permeability, and low strength.

This unit is poorly suited to standard systems of waste disposal because of the wetness and the very slow permeability. Alternative waste disposal systems may function properly on this unit. Suitable included soils are throughout the unit. Onsite investigation is needed to locate such soils.

A drainage system is needed if roads or building foundations are constructed on this unit. The wetness can be reduced by installing drainage tile around footings. Properly designing foundations and footings, diverting runoff away from the buildings, and backfilling with material that has a low shrink-swell potential help to prevent the structural damage caused by shrinking and swelling. Properly designing buildings and roads helps to offset the limited ability of the soil to support a load.

Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. In many areas it may be necessary to haul in topsoil for lawns and gardens. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

The vegetative site is Poorly Drained Bottom.

140G—Pearsoll-Dubakella complex, rocky, 20 to 60 percent slopes. This map unit is on hillslopes. Elevation is 1,200 to 4,100 feet. The mean annual precipitation is 35 to 60 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation on the Pearsoll soil is mainly grasses, shrubs, and forbs and a few scattered conifers. That on the Dubakella soil is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 60 percent Pearsoll soil and 20 percent Dubakella soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Rock outcrop on ridges and convex slopes; Acker, Beekman, Gravecreek, Josephine, Norling, and Speaker soils; and, on concave slopes and foot slopes, soils that are similar to the Dubakella soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Pearsoll and Dubakella soils that have slopes of less than 20 or more than 60 percent. Included areas make up about 20 percent of the total acreage.

The Pearsoll soil is shallow and well drained. It formed in colluvium derived dominantly from peridotite and serpentinite. Typically, the surface is covered with a layer of needles, leaves, and twigs about ½ inch thick. The surface layer is dark brown extremely stony clay loam about 7 inches thick. The subsoil is dark brown very cobbly and extremely cobbly clay about 12 inches thick. Bedrock is at a depth of about 19 inches. The depth to bedrock ranges from 10 to 20 inches.

Permeability is slow in the Pearsoll soil. Available water capacity is about 1 inch. The effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is high.

The Dubakella soil is moderately deep and well drained. It formed in colluvium derived dominantly from peridotite and serpentinite. Typically, the surface layer is dark reddish brown very stony clay loam about 11 inches thick. The subsoil is dark reddish brown very cobbly clay about 20 inches thick. Bedrock is at a depth of about 31 inches. The depth to bedrock ranges from 20 to 40 inches.

Permeability is slow in the Dubakella soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for wildlife habitat and limited timber production. It is poorly suited to timber production. The plant community on the Pearsoll soil includes scattered Jeffrey pine and an occasional incense cedar or Douglas fir. The understory vegetation is mainly sheep fescue, California fescue, and Indian dream fern.

The plant community on the Dubakella soil includes Douglas fir, Jeffrey pine, incense cedar, and Pacific madrone. The understory vegetation is mainly canyon live oak, common snowberry, and California fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 80 on the Dubakella soil. The yield at culmination of the mean annual increment is 4,060 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years and 23,360 board feet per acre (Scribner rule) at 160 years. On the basis of a 50-year curve, the mean site index is 60.

The main limitations affecting timber production on the Dubakella soil are the slope, low fertility, erosion, compaction, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

When timber is harvested, management that minimizes the risk of erosion is essential. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. Rock outcrop and stones can cause breakage of falling timber and can hinder yarding. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Building the roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer during summer, the large number of rock fragments in the soil, and the low available water capacity increase the seedling mortality rate. A high content of magnesium and low content of calcium also increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced by providing artificial shade for seedlings. Reforestation can be accomplished by planting Jeffrey pine and incense cedar seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

Increased erosion, loss of plant nutrients, and water repellency are likely to result from fires of moderate intensity.

The vegetative site in areas of the Pearsoll soil is Shallow Serpentine, 30- 40-inch precipitation zone, and the one in areas of the Dubakella soil is Douglas Fir-Pine Forest, Serpentine.

141A—Phoenix clay, 0 to 3 percent slopes. This moderately deep, poorly drained soil is on alluvial fans. It formed in alluvium derived dominantly from tuff and breccia. Elevation is 1,200 to 1,700 feet. The mean annual precipitation is 18 to 25 inches, the mean annual temperature is 50 to 54 degrees F, and the average frost-free period is 160 to 180 days. The native vegetation is mainly grasses, sedges, and forbs.

Typically, the surface layer is dark gray clay about 20 inches thick. The subsoil is dark gray and gray clay about 20 inches thick. Weathered bedrock is at a depth of about 40 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is gravelly or cobbly.

Included in this unit are small areas of Carney soils on convex slopes, Padigan soils on concave slopes, Coker and Winlo soils, and soils that are similar to the Phoenix soil but have bedrock at a depth of 40 to 60 inches. Also included are small areas of Phoenix soils that have slopes of more than 3 percent. Included areas make up about 10 percent of the total acreage.

Permeability is very slow in the Phoenix soil. Available water capacity is about 4 inches. The effective rooting depth is limited by the water table, which is within a depth of 0.5 foot from December through May. Runoff is slow, and the hazard of water erosion is slight.

This unit is used mainly for hay and pasture or for tree fruit. It also is used for homesite development.

This unit is suited to permanent pasture. It is limited mainly by wetness, the high content of clay, and a slow rate of water intake. The ability of tile drains to remove subsurface water from the soil is limited because of the very slow permeability.

In summer, irrigation is needed for the maximum production of most forage crops. Sprinkler irrigation is the best method of applying water. This method permits an even, controlled application of water, helps to prevent excessive runoff, and minimizes the risk of erosion. Border and contour flood irrigation systems also are suitable. For the efficient application and removal of surface irrigation water, land leveling is needed. Because of the very slow permeability and depth to the water table, water applications should be regulated so that the water does not stand on the surface and damage the crop. Land smoothing and open ditches can reduce surface wetness. The use of pipe, ditch lining, or drop structures in irrigation ditches reduces water loss and the hazard of erosion.

Wetness limits the choice of suitable forage plants and the period of cutting or grazing and increases the risk of winterkill. The high content of clay severely limits tillage and root growth. Deep cracks form as the soil dries in summer. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

Solid-set sprinkler irrigation is the best method of controlling frost and providing adequate moisture for tree fruit. Compaction can be minimized by limiting the use of equipment when the soil is wet. A permanent cover crop helps to control runoff and erosion.

This unit is poorly suited to homesite development. The main limitations are the wetness, a high shrink-swell potential, the very slow permeability, the depth to bedrock, and low strength.

This unit is poorly suited to standard systems of waste disposal because of the wetness, the depth to bedrock, and the very slow permeability. Alternative waste disposal systems may function properly on this unit. Suitable included soils are throughout the unit. Onsite investigation is needed to locate such soils.

A drainage system is needed if roads or building foundations are constructed on this unit. The wetness can be reduced by installing drainage tile around footings. Properly designing foundations and footings, diverting runoff away from the buildings, and backfilling with material that has a low shrink-swell potential help to prevent the structural damage caused by shrinking and swelling. Properly designing buildings and roads helps to offset the limited ability of the soil to support a load.

Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. In many areas it may be necessary to haul in topsoil for lawns and gardens. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

The vegetative site is Poorly Drained Bottom.

142C—Pinehurst loam, 3 to 12 percent slopes. This very deep, well drained soil is on plateaus. It formed in colluvium derived from basalt and andesite. Elevation is 3,600 to 5,500 feet. The mean annual precipitation is 30 to 55 inches, the mean annual temperature is 40 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles and twigs about 1 inch thick. The surface layer is dark reddish brown loam about 15 inches thick. The subsoil to a depth of 60 inches is dark reddish brown clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is stony.

Included in this unit are small areas of Kanutchan and Sibannac soils in basins and near drainageways, Bybee and Tatouche soils on concave slopes, Farva and Woodseye soils and Rock outcrop on convex slopes, and soils that are similar to the Pinehurst soil but have bedrock within a depth of 60 inches. Also included are small areas of Pinehurst soils that have slopes of less than 3 or more than 12 percent. Included areas make up about 10 percent of the total acreage.

Permeability is moderately slow in the Pinehurst soil. Available water capacity is about 10 inches. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and white fir. Other species that grow on this unit include Pacific yew and sierra chinkapin. The understory vegetation includes onesided wintergreen, cascade Oregongrape, and American twinflower.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 110. The yield at culmination of the mean annual increment is 5,880 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 48,300 board feet per acre (Scribner rule) at 140 years. On the basis of a 50-year curve, the mean site index is 75.

On the basis of a 50-year site curve, the mean site index for white fir is 75. The yield at culmination of the mean annual increment is 12,530 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years.

The main limitations affecting timber production are compaction, erosion, seedling mortality, and plant competition. Conventional methods of harvesting timber generally are suitable, but the soil may be compacted if it is moist when heavy equipment is used. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Erosion can be controlled by carefully planning the construction and maintenance of logging roads, skid trails, and landings. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Severe frost can damage or kill seedlings. Air drainage is restricted on this unit. Proper timber harvesting methods can reduce the effect of frost on regeneration. Reforestation can be accomplished by planting seedlings of frost-tolerant species, such as ponderosa pine and lodgepole pine.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

The main limitation affecting livestock grazing is compaction. The native vegetation suitable for grazing includes western fescue, mountain brome, tall trisetum, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Yew Forest.

143E—Pinehurst loam, 12 to 35 percent north slopes. This very deep, well drained soil is on hillslopes. It formed in colluvium derived from basalt and andesite. Elevation is 3,600 to 5,500 feet. The mean annual precipitation is 30 to 55 inches, the mean annual temperature is 40 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles and twigs about 1 inch thick. The surface layer is dark reddish brown loam about 15 inches thick. The subsoil to a depth of 60 inches is dark reddish brown clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is stony.

Included in this unit are small areas of Kanutchan and Sibannac soils in basins and near drainageways, Bybee and Tatouche soils on concave slopes, Farva and Woodseye soils and Rock outcrop on ridges and convex slopes, and soils that are similar to the Pinehurst soil but have bedrock within a depth of 60 inches. Also included are small areas of Pinehurst soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately slow in the Pinehurst soil. Available water capacity is about 10 inches. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and white fir. Other species that grow on this unit include Pacific yew and sierra chinkapin. The understory vegetation includes onesided wintergreen, cascade Oregongrape, and American twinflower.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 115. The yield at culmination of the mean annual increment is 6,360 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 48,300 board feet per acre (Scribner rule) at 140 years. On the basis of a 50-year curve, the mean site index is 85.

On the basis of a 50-year site curve, the mean site index for white fir is 75. The yield at culmination of the mean annual increment is 12,570 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years.

The main limitations affecting timber production are erosion, compaction, plant competition, and seedling mortality. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting ponderosa pine and Douglas fir seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

Severe frost can damage or kill seedlings. In the less sloping areas where air drainage may be restricted, proper timber harvesting methods can reduce the effect of frost on regeneration.

The main limitations affecting livestock grazing are compaction and erosion. The native vegetation suitable for grazing includes western fescue, mountain brome, tall trisetum, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Yew Forest.

144E—Pinehurst loam, 12 to 35 percent south slopes. This very deep, well drained soil is on hillslopes. It formed in colluvium derived from basalt and andesite. Elevation is 3,600 to 5,500 feet. The mean annual precipitation is 30 to 55 inches, the mean annual temperature is 40 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles and twigs about 1 inch thick. The surface layer is dark reddish brown loam about 15 inches thick. The subsoil to a depth of 60 inches is dark reddish brown clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is stony.

Included in this unit are small areas of Kanutchan and Sibannac soils in basins and near drainageways, Bybee and Tatouche soils on concave slopes, Farva and Woodseye soils and Rock outcrop on ridges and convex slopes, and soils that are similar to the Pinehurst soil but have bedrock within a depth of 60 inches. Also included are small areas of Pinehurst soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately slow in the Pinehurst soil. Available water capacity is about 10 inches. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and white fir. Other species that grow on this unit include ponderosa pine and incense cedar. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and common snowberry.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 110. The yield at culmination of the mean annual increment is 5,880 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 37,120 board feet per acre (Scribner rule) at 160 years. On the basis of a 50-year curve, the mean site index is 75.

On the basis of a 50-year site curve, the mean site index for white fir is 75. The yield at culmination of the mean annual increment is 12,530 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years.

The main limitations affecting timber production are erosion, compaction, seedling mortality, and plant competition. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings.

Reforestation can be accomplished by planting ponderosa pine and Douglas fir seedlings.

Severe frost can damage or kill seedlings. In the less sloping areas where air drainage may be restricted, proper timber harvesting methods can reduce the effect of frost on regeneration.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

The main limitations affecting livestock grazing are compaction and erosion. The native vegetation suitable for grazing includes western fescue, mountain brome, tall trisetum, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Serviceberry Forest.

145C—Pinehurst-Greystoke complex, 1 to 12 percent slopes. This map unit is on plateaus. Elevation is 3,500 to 4,800 feet. The mean annual precipitation is 20 to 30 inches, the mean annual temperature is 42 to 46 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

This unit is about 65 percent Pinehurst soil and 20 percent Greystoke soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Merlin and Royst soils, Rock outcrop and Kanutchan soils near drainageways and on concave slopes, and soils that are similar to the Pinehurst soil but have bedrock within a depth of 60 inches. Also included are small areas of Pinehurst and Greystoke soils that have slopes of more than 12 percent. Included areas make up about 15 percent of the total acreage.

The Pinehurst soil is very deep and well drained. It formed in colluvium derived dominantly from andesite. Typically, the surface is covered with a layer of needles and twigs about 1 inch thick. The surface layer is dark reddish brown loam about 15 inches thick. The subsoil is dark reddish brown clay loam about 45 inches thick. The depth to bedrock is 60 inches or more. In some areas the surface layer is stony.

Permeability is moderately slow in the Pinehurst soil. Available water capacity is about 10 inches. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

The Greystoke soil is deep and well drained. It formed in residuum and colluvium derived dominantly from andesite. Typically, the surface is covered with a layer of needles and twigs about 1 inch thick. The surface layer is dark reddish brown stony loam about 3 inches thick. The next layer is dark reddish brown very cobbly loam about 10 inches thick. The upper 10 inches of the subsoil also is dark reddish brown very cobbly loam. The lower 19 inches is dark reddish brown extremely gravelly clay loam. Weathered bedrock is at a depth of about 42 inches. The depth to bedrock ranges from 40 to 60 inches.

Permeability is moderately slow in the Greystoke soil. Available water capacity is about 4 inches. The effective rooting depth is 40 to 60 inches. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include incense cedar, white fir, and sugar pine. The understory vegetation includes tall Oregon grape, pachystima, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 100 on the Pinehurst soil. The yield at culmination of the mean annual increment is 5,040 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 39,750 board feet per acre (Scribner rule) at 150 years. On the basis of a 50-year curve, the mean site index is 75.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 95 on the Pinehurst soil. The yield at culmination of the mean annual increment is 3,760 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 43,160 board feet per acre (Scribner rule) at 130 years.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 90 on the Greystoke soil. The yield at culmination of the mean annual increment is 4,200 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 31,840 board feet per acre (Scribner rule) at 160 years. On the basis of a 50-year curve, the mean site index is 65.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 90 on the Greystoke soil. The yield at culmination of the mean annual increment is 3,400 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 37,960 board feet per acre (Scribner rule) at 130 years.

The main limitations affecting timber production are compaction, erosion, seedling mortality, and plant competition. Conventional methods of harvesting timber generally are suitable, but the soils may be compacted if they are moist when heavy equipment is used. Puddling can occur when the soils are wet. If the soils are excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Erosion can be controlled by carefully planning the construction and maintenance of logging roads, skid trails, and landings. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Severe frost can damage or kill seedlings. Air drainage is restricted on this unit. Proper timber harvesting methods can reduce the effect of frost on regeneration. Reforestation can be accomplished by planting seedlings of frost-tolerant species, such as ponderosa pine and lodgepole pine.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

The main limitation affecting livestock grazing is compaction. The native vegetation suitable for grazing includes western fescue, mountain brome, and tall trisetum. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soils. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Douglas Fir-Mixed Pine-Sedge Forest.

146—Pits, gravel. This map unit consists of sand and gravel pits and quarries. The pits are on flood plains and terraces along the major streams and rivers in the survey area. They are a major source of aggregate used in the construction of roads.

The quarries are on foothills and uplands. They are an excellent source of the various kinds of rock that are used for most of the roads built in the survey area.

This unit is not assigned to a vegetative site.

147C—Pokegema-Woodcock complex, 1 to 12 percent slopes. This map unit is on plateaus. Elevation is 3,800 to 6,600 feet. The mean annual precipitation is 25 to 35 inches, the mean annual temperature is 40 to 43 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

This unit is about 70 percent Pokegema soil and 20 percent Woodcock soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Merlin soils, Rock outcrop, Klamath soils near drainageways and on concave slopes, soils that are similar to the Pokegema soil but have bedrock at a depth of less than 40 or more than 60 inches, and soils that are similar to the Woodcock soil but have bedrock within a depth of 60 inches. Also included are small areas of Pokegema and Woodcock soils that have slopes of more than 12 percent. Included areas make up about 10 percent of the total acreage.

The Pokegema soil is deep and well drained. It formed in residuum derived dominantly from andesite. Typically, the surface is covered with a layer of needles and twigs about ½ inch thick. The surface layer is dark reddish brown loam about 8 inches thick. The upper 8 inches of the subsoil is dark reddish brown clay loam. The lower 22 inches is dark reddish brown gravelly clay. The substratum is dark reddish brown and reddish brown gravelly clay about 14 inches thick. Weathered bedrock is at a depth of about 52 inches. The depth to bedrock ranges from 40 to 60 inches. In some areas the surface layer is stony.

Permeability is moderately slow in the Pokegema soil. Available water capacity is about 6 inches. The effective rooting depth is 40 to 60 inches. Runoff is slow, and the hazard of water erosion is slight.

The Woodcock soil is very deep and well drained. It formed in colluvium derived dominantly from andesite. Typically, the surface is covered with a layer of needles and twigs about 1 inch thick. The surface layer is dark reddish brown stony loam about 4 inches thick. The next layer is dark reddish brown very gravelly loam about 12 inches thick. The subsoil is dark reddish brown very gravelly clay loam about 23 inches thick. The substratum to a depth of 62 inches is dark reddish brown gravelly clay loam. The depth to bedrock is 60 inches or more.

Permeability is moderate in the Woodcock soil. Available water capacity is about 4 inches. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include white fir, incense cedar, and sugar pine. The understory vegetation includes sierra chinkapin, tall Oregon grape, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 120 on the Pokegema soil and 110 on the Woodcock soil.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 105 on both the Pokegema and Woodcock soils. The yield at culmination of the mean annual increment is 4,480 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 50,040 board feet per acre (Scribner rule) at 120 years.

The main limitations affecting timber production are compaction, erosion, seedling mortality, and plant competition. Conventional methods of harvesting timber generally are suitable, but the soils may be compacted if they are moist when heavy equipment is used. Puddling can occur when the soils are wet. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Erosion can be controlled by carefully planning the construction and maintenance of logging roads, skid trails, and landings. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Severe frost can damage or kill seedlings. Air drainage is restricted on the unit. Proper timber harvesting methods can reduce the effect of frost on regeneration. Reforestation can be accomplished by planting seedlings of frost-tolerant species, such as ponderosa pine and lodgepole pine.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

The main limitation affecting livestock grazing is compaction. The native vegetation suitable for grazing includes western fescue, sedge, mountain brome, and tall trisetum. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soils. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production.

The vegetative site is Mixed Conifer-Chinkapin-Sedge Forest.

148C—Pokegema-Woodcock complex, warm, 1 to 12 percent slopes. This map unit is on plateaus. Elevation is 4,300 to 5,000 feet. The mean annual precipitation is 25 to 35 inches, the mean annual temperature is 40 to 43 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

This unit is about 70 percent Pokegema soil and 20 percent Woodcock soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Merlin soils, small areas of Rock outcrop, and small areas of Klamath and Kanutchan Variant soils near drainageways and on concave slopes. Also included are small areas of soils that are similar to the Pokegema soil but have bedrock at a depth of less than 40 or more than 60 inches, soils that are similar to the Woodcock soil but have bedrock within a depth of 60 inches, and Pokegema and Woodcock soils that have slopes of more than 12 percent. Included areas make up about 10 percent of the total acreage.

The Pokegema soil is deep and well drained. It formed in residuum derived dominantly from andesite. Typically, the surface is covered with a layer of needles and twigs about ½ inch thick. The surface layer is dark reddish brown loam about 8 inches thick. The upper 8 inches of the subsoil is dark reddish brown clay loam. The lower 22 inches is dark reddish brown gravelly clay. The substratum is dark reddish brown and reddish brown gravelly clay about 14 inches thick. Weathered bedrock is at a depth of about 52 inches. The depth to bedrock ranges from 40 to 60 inches. In some areas the surface layer is stony.

Permeability is moderately slow in the Pokegema soil. Available water capacity is about 66 inches. The effective rooting depth is 40 to 60 inches. Runoff is slow, and the hazard of water erosion is slight.

The Woodcock soil is very deep and well drained. It formed in colluvium derived dominantly from andesite. Typically, the surface is covered with a layer of needles and twigs about 1 inch thick. The surface layer is dark reddish brown stony loam about 4 inches thick. The next layer is dark reddish brown very gravelly loam about 12 inches thick. The subsoil is dark reddish brown very gravelly clay loam about 23 inches thick. The substratum to a depth of 62 inches is dark reddish brown gravelly clay loam. The depth to bedrock is 60 inches or more.

Permeability is moderate in the Woodcock soil. Available water capacity is about 4 inches. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include white fir, incense cedar, and sugar pine. The understory vegetation includes sierra chinkapin, antelope bitterbrush, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 120 on the Pokegema soil and 110 on the Woodcock soil.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 105 on both the Pokegema and Woodcock soils. The yield at culmination of the mean annual increment is 4,480 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 50,040 board feet per acre (Scribner rule) at 120 years.

The main limitations affecting timber production are compaction, erosion, seedling mortality, and plant competition. Conventional methods of harvesting timber generally are suitable, but the soils may be compacted if they are moist when heavy equipment is used. Puddling can occur when the soils are wet. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Erosion can be controlled by carefully planning the construction and maintenance of logging roads, skid trails, and landings. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Severe frost can damage or kill seedlings. Air drainage is restricted on the unit. Proper timber harvesting methods can reduce the effect of frost on regeneration. Reforestation can be accomplished by planting seedlings of frost-tolerant species, such as ponderosa pine and lodgepole pine.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

The main limitation affecting livestock grazing is compaction. The native vegetation suitable for grazing includes western fescue, sedge, mountain brome, and tall trisetum. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soils. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production.

The vegetative site is Mixed Conifer-Bitterbrush-Sedge Forest.

149B—Pollard loam, 2 to 7 percent slopes. This very deep, well drained soil is on alluvial fans. It formed in alluvium derived dominantly from metamorphic rock. Elevation is 1,200 to 4,000 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about 2 inches thick. The surface layer is dark brown loam about 11 inches thick. The upper 25 inches of the subsoil is dark reddish brown clay loam. The lower 25 inches is yellowish red and brown clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is clay loam or gravelly loam.

Included in this unit are small areas of Abegg, Josephine, and Wolfpeak soils; poorly drained soils near drainageways and on concave slopes; and Pollard soils that have slopes of more than 7 percent. Included areas make up about 15 percent of the total acreage.

Permeability is slow in the Pollard soil. Available water capacity is about 7 inches. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

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

This unit is suited to the production of Douglas fir. Other species that grow on this unit include ponderosa pine, sugar pine, and California black oak. The understory vegetation includes canyon live oak, deerbrush, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 125. The yield at culmination of the mean annual increment is 7,320 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 58,200 board feet per acre (Scribner rule) at 120 years. On the basis of a 50-year curve, the mean site index is 95.

The main limitations affecting timber production are compaction and plant competition. Conventional methods of harvesting timber generally are suitable, but the soil may be compacted if it is moist when heavy equipment is used. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Erosion can be controlled by carefully planning the construction and maintenance of logging roads, skid trails, and landings. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

This unit is well suited to irrigated crops. It is limited mainly by the moderately slow permeability. In summer, irrigation is needed for the maximum production of most crops. Sprinkler irrigation is the best method of applying water. This method permits an even, controlled application of water, helps to prevent excessive runoff, and minimizes the risk of erosion. Border and contour flood irrigation systems also are suitable. For the efficient application and removal of surface irrigation water, land leveling is needed. To prevent overirrigation and excessive erosion, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. The use of pipe, ditch lining, or drop structures in irrigation ditches reduces water loss and the hazard of erosion.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Leaving crop residue on or near the surface helps to conserve moisture and control erosion.

A tillage pan forms easily if the soil is tilled when wet. Chiseling or subsoiling breaks up the pan. Surface crusting and compaction can be minimized by returning crop residue to the soil.

Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

This unit is well suited to homesite development. The main limitations are the moderately slow permeability and the shrink-swell potential. The moderately slow permeability can be overcome by increasing the size of the absorption field.

If buildings are constructed on this unit, properly designing foundations and footings, diverting runoff away from the buildings, and backfilling with material that has a low shrink-swell potential help to prevent the structural damage caused by shrinking and swelling. Properly designing buildings and roads helps to offset the limited ability of the soil to support a load.

Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

The vegetative site is Douglas Fir-Black Oak Forest.

149D—Pollard loam, 7 to 20 percent slopes. This very deep, well drained soil is on alluvial fans. It formed in alluvium derived dominantly from metamorphic rock. Elevation is 1,200 to 4,000 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about 2 inches thick. The surface layer is dark brown loam about 11 inches thick. The upper 25 inches of the subsoil is dark reddish brown clay loam. The lower 25 inches is yellowish red and brown clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is clay loam or gravelly loam.

Included in this unit are small areas of Abegg, Josephine, Speaker, and Wolfpeak soils; poorly drained soils near drainageways and on concave slopes; and Pollard soils that have slopes of less than 7 or more than 20 percent. Included areas make up about 20 percent of the total acreage.

Permeability is slow in the Pollard soil. Available water capacity is about 7 inches. The effective rooting depth is 60 inches or more. Runoff is slow or medium, and the hazard of water erosion is slight or moderate.

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

This unit is suited to the production of Douglas fir. Other species that grow on this unit include ponderosa pine, sugar pine, and California black oak. The understory vegetation includes canyon live oak, deerbrush, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 125. The yield at culmination of the mean annual increment is 7,320 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 58,200 board feet per acre (Scribner rule) at 120 years. On the basis of a 50-year curve, the mean site index is 95.

The main limitations affecting timber production are compaction, erosion, and plant competition. Conventional methods of harvesting timber generally are suitable, but the soil may be compacted if it is moist when heavy equipment is used. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Erosion can be controlled by carefully planning the construction and maintenance of logging roads, skid trails, and landings. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

This unit is well suited to irrigated crops. It is limited mainly by the slope, the hazard of erosion, and the moderately slow permeability. In summer, irrigation is needed for the maximum production of most crops. Because of the slope, sprinkler irrigation is the best method of applying water. This method permits an even, controlled application of water, helps to prevent excessive runoff, and minimizes the risk of erosion. To prevent overirrigation and excessive erosion, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Leaving crop residue on or near the surface helps to conserve moisture and control erosion.

A tillage pan forms easily if the soil is tilled when wet.

Chiseling or subsoiling breaks up the pan. Surface crusting and compaction can be minimized by returning crop residue to the soil.

Seedbeds should be prepared on the contour or across the slope where practical. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

The main limitations affecting homesite development are the moderately slow permeability, the shrink-swell potential, and the slope. The moderately slow permeability can be overcome by increasing the size of the absorption field.

If buildings are constructed on this unit, properly designing foundations and footings, diverting runoff away from the buildings, and backfilling with material that has a low shrink-swell potential help to prevent the structural damage caused by shrinking and swelling. Properly designing buildings and roads helps to offset the limited ability of the soil to support a load.

Erosion is a hazard on the steeper slopes. Only the part of the site that is used for construction should be disturbed. Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

The vegetative site is Douglas Fir-Black Oak Forest.

150E—Provig very gravelly loam, 15 to 35 percent slopes. This very deep, well drained soil is on fan terrace scarps. It formed in alluvium derived from mixed sources. Elevation is 1,100 to 1,500 feet. The mean annual precipitation is 18 to 30 inches, the mean annual temperature is 52 to 54 degrees F, and the average frost-free period is 150 to 180 days. The native vegetation is mainly hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is very dark brown and very dark grayish brown very gravelly loam about 9 inches thick. The subsoil is dark brown very gravelly clay loam about 6 inches thick. The substratum to a depth of 60 inches is dark reddish brown and reddish brown, stratified extremely gravelly clay. In some areas the surface layer is very cobbly.

Included in this unit are small areas of Carney soils, Agate and Winlo soils on the shoulders of hillslopes, and soils that are similar to the Provig soil but have sandstone bedrock at a depth of 40 to 60 inches. Also included are small areas of Provig soils that have slopes of less than 15 or more than 35 percent. Included areas make up about 15 percent of the total acreage.

Permeability is slow in the Provig soil. Available water capacity is about 4 inches. The effective rooting depth is 14 to 20 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for livestock grazing or homesite development.

The main limitations affecting livestock grazing are compaction, the slope, the very gravelly surface layer, and droughtiness. The vegetation suitable for grazing includes Idaho fescue, bluebunch wheatgrass, and pine bluegrass. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. In places the use of ground equipment is limited by the gravel and cobbles on the surface and by the slope.

Range seeding is suitable if the site is in poor condition. The main limitations affecting seeding are droughtiness and the slope. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the slope.

The main limitations affecting homesite development are the slow permeability, the slope, a high shrink-swell potential, and the very gravelly surface layer.

This unit is poorly suited to standard systems of waste disposal because of the slow permeability and the slope. Alternative waste disposal systems may function properly on this unit. Suitable included soils are in some areas of the unit. Onsite investigation is needed to locate such soils.

The slope limits the use of the steeper areas of this unit for building site development. Properly designing foundations and footings, diverting runoff away from the buildings, and backfilling with material that has a low shrink-swell potential help to prevent the structural damage caused by shrinking and swelling.

Erosion is a hazard on the steeper slopes. Only the part of the site that is used for construction should be disturbed. Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. Establishing plants is difficult in areas where the surface layer has been removed. Mulching and applying fertilizer help to establish plants in cut areas. Gravel and cobbles should be removed from disturbed areas, particularly areas used for lawns. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. In many areas it may be necessary to haul in topsoil for lawns and gardens. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

The vegetative site is Loamy Hills, 20- to 35-inch precipitation zone.

151C—Provig-Agate complex, 5 to 15 percent slopes. This map unit is on fan terraces. Elevation is 1,100 to 1,850 feet. The mean annual precipitation is 18 to 30 inches, the mean annual temperature is 52 to 54 degrees F, and the average frost-free period is 150 to 180 days. The native vegetation on the Provig soil is mainly hardwoods and an understory of grasses, shrubs, and forbs. That on the Agate soil is mainly grasses, shrubs, and forbs.

This unit is about 60 percent Provig soil and 30 percent Agate soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Carney and Winlo soils, Cove and Padigan soils near drainageways and on concave slopes, and soils that are similar to the Provig soil but have sandstone bedrock at a depth of 40 to 60 inches. Also included are small areas of Provig and Agate soils that have slopes of less than 5 or more than 15 percent. Included areas make up about 10 percent of the total acreage.

The Provig soil is very deep and well drained. It formed in alluvium derived from mixed sources. Typically, the surface layer is very dark brown and very dark grayish brown very gravelly loam about 9 inches thick. The subsoil is dark brown very gravelly clay loam about 6 inches thick. The substratum to a depth of 60 inches is dark reddish brown and reddish brown, stratified extremely gravelly clay. In some areas the surface layer is very cobbly.

Permeability is slow in the Provig soil. Available water capacity is about 4 inches. The effective rooting depth is 14 to 20 inches. Runoff is medium, and the hazard of water erosion is moderate.

The Agate soil is moderately deep to a hardpan and is well drained. It formed in alluvium derived from mixed sources. Typically, the surface layer is dark brown loam about 6 inches thick. The next layer is dark yellowish brown clay loam about 6 inches thick. The upper 13 inches of the subsoil is dark brown clay loam. The lower 5 inches is a hardpan. The substratum to a depth of 62 inches is light olive brown extremely gravelly coarse sandy loam. Depth to the hardpan is 20 to 30 inches. The depth to bedrock is 60 inches or more. In some areas the surface layer is gravelly or cobbly.

Permeability is moderately slow in the Agate soil. Available water capacity is about 4 inches. The effective rooting depth is 20 to 30 inches. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for hay and pasture, homesite development, and livestock grazing.

The main limitations affecting the use of this unit for hay and pasture are compaction, droughtiness, the limited rooting depth, and the very gravelly surface layer of the Provig soil. In some areas ripping and shattering the hardpan in the Agate soil can increase the effective rooting depth.

If the pasture or range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. The grazing system should maintain the desired balance of species in the plant community. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soils from erosion. Grazing when the soils are wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth.

The native vegetation suitable for grazing includes Idaho fescue, bluebunch wheatgrass, pine bluegrass, and Lemmon needlegrass. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment.

Range seeding is suitable if the site is in poor condition. The main limitation is droughtiness. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both. In places the use of ground equipment is limited by the gravel on the surface of the Provig soil and the included Winlo soils.

In summer, irrigation is needed for the maximum production of hay and pasture. Because of the slope, sprinkler irrigation is the best method of applying water. This method permits an even, controlled application of water, helps to prevent excessive runoff, and minimizes the risk of erosion. To prevent overirrigation and excessive erosion, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

The main limitations affecting homesite development are the slow permeability, a high shrink-swell potential, the very gravelly surface layer in the Provig soil, and depth to the hardpan in the Agate soil.

This unit is poorly suited to standard systems of waste disposal because of depth to the hardpan in the Agate soil and the slow permeability in the Provig soil. The suitability of the Agate soil for septic tank absorption fields can be improved by ripping the hardpan. Alternative waste disposal systems may function properly on this unit. Suitable included soils are in some areas of the unit. Onsite investigation is needed to locate such soils.

If buildings are constructed on the Provig soil, properly designing foundations and footings, diverting runoff away from the buildings, and backfilling with material that has a low shrink-swell potential help to prevent the structural damage caused by shrinking and swelling.

Cuts needed to provide essentially level building sites can expose bedrock. Establishing plants is difficult in areas where the surface layer has been removed. Mulching and applying fertilizer help to establish plants in cut areas. Gravel and cobbles should be removed from disturbed areas, particularly areas used for lawns. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. In many areas it may be necessary to haul in topsoil for lawns and gardens. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

The vegetative site in areas of the Provig soil is Loamy Hills, 20- to 35-inch precipitation zone, and the one in areas of the Agate soil is Biscuit-Scabland (mound), 18- to 26-inch precipitation zone.

152B—Randcore-Shoat complex, 0 to 5 percent slopes. This map unit is on plateaus. Elevation is 2,000 to 3,800 feet. The mean annual precipitation is 18 to 25 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 150 days. The native vegetation is mainly grasses, shrubs, and forbs.

This unit is about 60 percent Randcore soil and 30 percent Shoat soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used. The soils occur as patterned land. Areas of the Randcore soil are between and around areas of the Shoat soil, which is on circular mounds (fig. 10).

Included in this unit are small areas of Lorella, Paragon, and Skookum soils; Rock outcrop; and soils that are similar to the Shoat soil but have bedrock at a depth of 10 to 20 inches or more than 40 inches. Also included are small areas of Randcore and Shoat soils that have slopes of more than 5 percent. Included areas make up about 10 percent of the total acreage.

The Randcore soil is very shallow and moderately well drained. It formed in loess over andesite. Typically, the surface layer is dark brown extremely stony loam about 1 inch thick. The next layer is dark brown loam about 5 inches thick. Bedrock is at a depth of about 6 inches. The depth to bedrock ranges from 4 to 10 inches.

Permeability is moderate in the Randcore soil. Available water capacity is about 1 inch. The effective rooting depth is 4 to 10 inches. This soil is ponded in January and February. Runoff is ponded, and the hazard of water erosion is slight.

The Shoat soil is moderately deep and well drained. It formed in loess over andesite. Typically, the surface layer is dark brown loam about 4 inches thick. The subsoil also is dark brown loam. It is about 20 inches thick. Bedrock is at a depth of about 24 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Permeability is moderate in the Shoat soil. Available water capacity is about 5 inches. The effective rooting depth is 20 to 40 inches. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for livestock grazing and wildlife habitat. The main limitations affecting livestock grazing are compaction and droughtiness in summer and fall. The Randcore soil also is limited by stones on the surface, wetness in winter and spring, and the depth to bedrock. The vegetation suitable for grazing includes bluebunch wheatgrass, Idaho fescue, and pine bluegrass. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment. The use of ground equipment generally is not practical because of the stones on the surface of the Randcore soil.

This unit is poorly suited to range seeding. The main

Figure 10.—An area of Randcore-Shoat complex, 0 to 5 percent slopes, which occurs as patterned land.

limitations in areas of the Randcore soil are the depth to bedrock, the stones on the surface, wetness in winter and spring, and droughtiness in summer and fall. The main limitation affecting seeding on the Shoat soil is droughtiness. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the depth to bedrock.

The vegetative site in areas of the Randcore soil is Biscuit-Scabland (intermound), 18- to 26-inch precipitation zone, and the one in areas of the Shoat soil is Biscuit-Scabland (mound), 18- to 26-inch precipitation zone.

153B—Reinecke-Coyata complex, 0 to 5 percent slopes. This map unit is on plateaus. Elevation is 2,600 to 3,800 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 150 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

This unit is about 55 percent Reinecke soil and 30 percent Coyata soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used. The Coyata soil commonly is on the more sloping parts of the landscape.

Included in this unit are small areas of Alcot, Crater Lake, and Dumont soils; soils that are similar to the

Reinecke soil but are overlain by less than 20 inches of ash; and soils that are similar to the Coyata soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Reinecke and Coyata soils that have slopes of more than 5 percent. Included areas make up about 15 percent of the total acreage.

The Reinecke soil is very deep and well drained. It formed in volcanic ash over residuum derived dominantly from andesite. Typically, the surface is covered with a layer of needles and twigs about 2 inches thick. The surface layer is dark brown sandy loam about 9 inches thick. The subsoil is brown gravelly sandy loam about 16 inches thick. It is underlain by a buried soil. The upper 8 inches of the buried soil is dark reddish brown loam. The lower 27 inches is dark reddish brown cobbly loam. The depth to bedrock is 60 inches or more.

Permeability is moderate in the Reinecke soil. Available water capacity is about 12 inches. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

The Coyata soil is moderately deep and well drained. It formed in colluvium derived dominantly from andesite. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1½ inches thick. The surface layer is dark reddish brown gravelly loam about 11 inches thick. The next layer is dark brown very cobbly clay loam about 10 inches thick. The subsoil is dark brown extremely cobbly clay loam about 10 inches thick. Bedrock is at a depth of about 31 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is cobbly or stony.

Permeability is moderate in the Coyata soil. Available water capacity is about 2 inches. The effective rooting depth is 20 to 40 inches. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir. Other species that grow on this unit include white fir, western hemlock, and golden chinkapin. The understory vegetation includes vine maple, California hazel, and cascade Oregongrape.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 145 on the Reinecke soil. The yield at culmination of the mean annual increment is 9,120 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 74,360 board feet per acre (Scribner rule) at 110 years. On the basis of a 50-year curve, the mean site index is 110.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 130 on the Coyata soil. The yield at culmination of the mean annual increment is 7,740 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 58,200 board feet per acre (Scribner rule) at 120 years. On the basis of a 50-year curve, the mean site index is 100.

The main limitations affecting timber production are compaction, plant competition, and seedling mortality. Conventional methods of harvesting timber generally are suitable, but the soils may be compacted if they are moist when heavy equipment is used. Because of the high content of volcanic ash in the Reinecke soil, displacement of the surface layer occurs most readily during dry periods. Puddling can occur when the soils are wet. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Logging roads require suitable surfacing for year-round use. Construction and maintenance of roads built on the Reinecke soil may be difficult because of the volcanic ash, which is poor subgrade material because it is not easily compacted when dry, has a moderate potential for frost action, and has a high water-holding capacity. When wet or moist, unsurfaced roads and skid trails are soft. They may be impassable during rainy periods. When dry, they are very dusty.

Erosion can be controlled by carefully planning the construction and maintenance of logging roads, skid trails, and landings. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

Severe frost can damage or kill seedlings. Air drainage may be restricted on this unit. Proper timber harvesting methods can reduce the effect of frost on regeneration.

The main limitation affecting livestock grazing is compaction. The Reinecke soil also is limited by soil displacement. The native vegetation suitable for grazing includes western fescue, mountain brome, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soils. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock. Displacement of the surface layer occurs most readily when the soils are dry.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion. The seedling mortality rate may be increased if the Reinecke soil is grazed when it is susceptible to displacement.

The vegetative site is Mixed Fir-Western Hemlock Forest.

154—Riverwash. This map unit consists of deep, excessively drained to very poorly drained, recently deposited alluvium in narrow, irregular strips along the major streams and rivers. Slope is 0 to 3 percent. Riverwash supports little, if any, vegetation. Elevation is 1,000 to 2,000 feet. The mean annual precipitation is 18 to 40 inches, the mean annual temperature is 48 to 54 degrees F, and the average frost-free period is 140 to 180 days.

Most areas of Riverwash are very cobbly, extremely cobbly, or extremely gravelly sand to a depth of 60 inches or more.

Included in this unit are small areas of Camas, Evans, and Newberg soils on flood plains and Takilma soils on terraces. Also included are small areas of Dumps and Xerorthents.

Permeability is very rapid in the areas of Riverwash. Available water capacity is low. Runoff is slow, and the hazard of water erosion is slight to severe. This unit is subject to flooding during prolonged, high-intensity storms. Channeling and deposition are common along streambanks.

This unit is used mainly for wildlife habitat. A few areas are used as a source of sand and gravel. Because it is frequently flooded, the unit is unsuited to most other uses.

This unit is not assigned to a vegetative site.

155E—Rogue cobbly coarse sandy loam, 12 to 35 percent north slopes. This deep, somewhat excessively drained soil is on hillslopes. It formed in colluvium derived dominantly from granitic rock. Elevation is 3,600 to 6,000 feet. The mean annual precipitation is 35 to 55 inches, the mean annual temperature is 40 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is very dark grayish brown cobbly coarse sandy loam about 6 inches thick. The subsoil is brown and yellowish brown cobbly coarse sandy loam about 28 inches thick. The substratum is light olive brown and light yellowish brown coarse sandy loam about 20 inches thick. Weathered bedrock is at a depth of about 54 inches. The depth to bedrock ranges from 40 to 60 inches. In some areas the surface layer is stony or very cobbly.

Included in this unit are small areas of poorly drained soils near drainageways and on concave slopes and soils that are similar to the Rogue soil but have more than 35 percent rock fragments or have bedrock at a depth of less than 40 or more than 60 inches. Also included are small areas of Rogue soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately rapid in the Rogue soil. Available water capacity is about 4 inches. The effective rooting depth is 40 to 60 inches. Runoff is medium, and the hazard of water erosion is high.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of white fir. Other species that grow on this unit include Douglas fir, incense cedar, and ponderosa pine. The understory vegetation includes creambush oceanspray, cascade Oregongrape, and whitevein shinleaf.

On the basis of a 50-year site curve, the mean site index for white fir is 80. The yield at culmination of the mean annual increment is 13,720 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years.

The main limitations affecting timber production are erosion, compaction, plant competition, and seedling mortality. When timber is harvested, management that minimizes the risk of erosion is essential. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

This unit is subject to slumping, especially in areas adjacent to drainageways. Road failure and landslides are likely to occur after road construction and clearcutting. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir and white fir seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. The large number of rock fragments in the soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings.

Severe frost can damage or kill seedlings. In the less sloping areas where air drainage may be restricted, proper timber harvesting methods can reduce the effect of frost on regeneration.

Increased erosion, loss of plant nutrients, and water repellency are likely to result from fires of moderate intensity.

The main limitations affecting livestock grazing are compaction and erosion. The native vegetation suitable for grazing includes western fescue, mountain brome, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Oceanspray Forest.

155G—Rogue cobbly coarse sandy loam, 35 to 80 percent north slopes. This deep, somewhat excessively drained soil is on hillslopes. It formed in colluvium derived dominantly from granitic rock. Elevation is 3,600 to 6,000 feet. The mean annual precipitation is 35 to 55 inches, the mean annual temperature is 40 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is very dark grayish brown cobbly coarse sandy loam about 6 inches thick. The subsoil is brown and yellowish brown cobbly coarse sandy loam about 28 inches thick. The substratum is light olive brown and light yellowish brown coarse sandy loam about 20 inches thick. Weathered bedrock is at a depth of about 54 inches. The depth to bedrock ranges from 40 to 60 inches. In some areas the surface layer is stony or very cobbly.

Included in this unit are small areas of poorly drained soils near drainageways and soils that are similar to the Rogue soil but have more than 35 percent rock fragments or have bedrock at a depth of less than 40 or more than 60 inches. Also included are small areas of Rogue soils that have slopes of less than 35 or more than 80 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately rapid in the Rogue soil. Available water capacity is about 4 inches. The effective rooting depth is 40 to 60 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of white fir. Other species that grow on this unit include Douglas fir, incense cedar, and ponderosa pine. The understory vegetation includes creambush oceanspray, cascade Oregongrape, and whitevein shinleaf.

On the basis of a 50-year site curve, the mean site index for white fir is 80. The yield at culmination of the mean annual increment is 13,720 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years.

The main limitations affecting timber production are the slope, erosion, compaction, plant competition, and seedling mortality. When timber is harvested, management that minimizes the risk of erosion is essential. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

This unit is subject to slumping, especially in areas adjacent to drainageways. Road failure and landslides are likely to occur after road construction and clearcutting. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Building logging roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir and white fir seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. The large number of rock fragments in the soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings.

Severe frost can damage or kill seedlings. Proper timber harvesting methods can reduce the effect of frost on regeneration.

Increased erosion, loss of plant nutrients, and water repellency are likely to result from fires of moderate intensity.

The main limitations affecting livestock grazing are erosion, compaction, and the slope. The native vegetation suitable for grazing includes western fescue, mountain brome, and Alaska oniongrass.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Oceanspray Forest.

156E—Rogue cobbly coarse sandy loam, 12 to 35 percent south slopes. This deep, somewhat excessively drained soil is on hillslopes. It formed in colluvium derived dominantly from granitic rock. Elevation is 3,600 to 6,000 feet. The mean annual precipitation is 35 to 55 inches, the mean annual temperature is 40 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is very dark grayish brown cobbly coarse sandy loam about 6 inches thick. The subsoil is brown and yellowish brown cobbly coarse sandy loam about 28 inches thick. The substratum is light olive brown and light yellowish brown coarse sandy loam about 20 inches thick. Weathered bedrock is at a depth of about 54 inches. The depth to bedrock ranges from 40 to 60 inches. In some areas the surface layer is stony or very cobbly.

Included in this unit are small areas of poorly drained soils near drainageways and on concave slopes and soils that are similar to the Rogue soil but have more than 35 percent rock fragments or have bedrock at a depth of less than 40 or more than 60 inches. Also included are small areas of Rogue soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately rapid in the Rogue soil. Available water capacity is about 4 inches. The effective rooting depth is 40 to 60 inches. Runoff is medium, and the hazard of water erosion is high.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of white fir and Douglas fir. Other species that grow on this unit include incense cedar and ponderosa pine. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and common snowberry.

On the basis of a 50-year site curve, the mean site index for white fir is 70. The yield at culmination of the mean annual increment is 11,410 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 100. The yield at culmination of the mean annual increment is 5,040 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 39,750 board feet per acre (Scribner rule) at 150 years. On the basis of a 50-year curve, the mean site index is 70.

The main limitations affecting timber production are erosion, compaction, seedling mortality, and plant competition. When timber is harvested, management that minimizes the risk of erosion is essential. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface.

Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

This unit is subject to slumping, especially in areas adjacent to drainageways. Road failure and landslides are likely to occur after road construction and clearcutting. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. The large number of rock fragments in the soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced by providing artificial shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Severe frost can damage or kill seedlings. In the less sloping areas where air drainage may be restricted, proper timber harvesting methods can reduce the effect of frost on regeneration.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

Increased erosion, loss of plant nutrients, and water repellency are likely to result from fires of moderate intensity.

The main limitations affecting livestock grazing are compaction and erosion. The native vegetation suitable for grazing includes western fescue, mountain brome, tall trisetum, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Serviceberry Forest.

156G—Rogue cobbly coarse sandy loam, 35 to 75 percent south slopes. This deep, somewhat excessively drained soil is on hillslopes. It formed in colluvium derived dominantly from granitic rock. Elevation is 3,600 to 6,000 feet. The mean annual precipitation is 35 to 55 inches, the mean annual temperature is 40 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is very dark grayish brown cobbly coarse sandy loam about 6 inches thick. The subsoil is brown and yellowish brown cobbly coarse sandy loam about 28 inches thick. The substratum is light olive brown and light yellowish brown coarse sandy loam about 20 inches thick. Weathered bedrock is at a depth of about 54 inches. The depth to bedrock ranges from 40 to 60 inches. In some areas the surface layer is stony or very cobbly.

Included in this unit are small areas of poorly drained soils near drainageways and soils that are similar to the Rogue soil but have more than 35 percent rock fragments or have bedrock at a depth of less than 40 or more than 60 inches. Also included are small areas of Rogue soils that have slopes of less than 35 or more than 75 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately rapid in the Rogue soil. Available water capacity is about 4 inches. The effective rooting depth is 40 to 60 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of white fir and Douglas fir. Other species that grow on this unit include incense cedar and ponderosa pine. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and common snowberry.

On the basis of a 50-year site curve, the mean site index for white fir is 70. The yield at culmination of the mean annual increment is 11,410 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 100. The yield at culmination of the mean annual increment is 5,040 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 39,750 board feet per acre (Scribner rule) at 150 years. On the basis of a 50-year curve, the mean site index is 70.

The main limitations affecting timber production are the slope, erosion, compaction, seedling mortality, and plant competition. When timber is harvested, management that minimizes the risk of erosion is essential. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface.

Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

This unit is subject to slumping, especially in areas adjacent to drainageways. Road failure and landslides are likely to occur after road construction and clearcutting. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Building logging roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. The large number of rock fragments in the soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced by providing artificial shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Severe frost can damage or kill seedlings. Proper timber harvesting methods can reduce the effect of frost on regeneration.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

Increased erosion, loss of plant nutrients, and water repellency are likely to result from fires of moderate intensity.

The main limitations affecting livestock grazing are erosion, compaction, and the slope. The native vegetation suitable for grazing includes western fescue, mountain brome, tall trisetum, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Serviceberry Forest.

157B—Ruch silt loam, 2 to 7 percent slopes. This very deep, well drained soil is on alluvial fans. It formed in alluvium derived dominantly from metamorphic rock. Elevation is 1,000 to 3,000 feet. The mean annual precipitation is 20 to 35 inches, the mean annual temperature is 50 to 54 degrees F, and the average frost-free period is 140 to 180 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is dark brown silt loam about 7 inches thick. The upper 10 inches of the subsoil is reddish brown loam. The lower 53 inches is yellowish red loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is gravelly, cobbly, or stony.

Included in this unit are small areas of Camas, Evans, and Newberg soils on flood plains; Gregory soils near drainageways; Selmac soils on concave slopes; Coleman, Foehlin, and Medford soils on terraces; and Abegg, Manita, Shefflein, and Vannoy soils. Also included are small areas of Xerorthents, small areas of Dumps, and small areas of Ruch soils that have slopes of more than 7 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately slow in the Ruch soil. Available water capacity is about 8 inches. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for irrigated crops, such as alfalfa hay, small grain, and tree fruit. Other crops include corn for silage and grass-legume hay. Some areas are used for timber production, pasture, or homesite development.

This unit is well suited to irrigated crops. It is limited mainly by the moderately slow permeability. In summer, irrigation is needed for the maximum production of most crops. Furrow, border, corrugation, trickle, and sprinkler irrigation systems are suitable. The system used generally is governed by the crop that is grown. For the efficient application and removal of surface irrigation water, land leveling is needed. To prevent overirrigation and excessive erosion, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. The use of pipe, ditch lining, or drop structures in irrigation ditches reduces water loss and the hazard of erosion.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Leaving crop residue on or near the surface helps to conserve moisture and control erosion.

A tillage pan forms easily if the soil is tilled when wet. Chiseling or subsoiling breaks up the pan. Surface crusting and compaction can be minimized by returning crop residue to the soil.

Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

Solid-set sprinkler irrigation is the best method of controlling frost and providing adequate moisture for tree fruit. Compaction can be minimized by limiting the use of equipment when the soil is wet. A permanent cover crop helps to control runoff and erosion.

This unit is well suited to homesite development. It has few limitations. Revegetating as soon as possible in disturbed areas around construction sites helps to control erosion. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. In summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

This unit is suited to the production of ponderosa pine and Douglas fir. Other species that grow on this unit include incense cedar, sugar pine, and Pacific madrone. The understory vegetation includes deerbrush, tall Oregon grape, and western fescue.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 115. The yield at culmination of the mean annual increment is 5,280 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 56,780 board feet per acre (Scribner rule) at 110 years.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 90. The yield at culmination of the mean annual increment is 4,200 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 31,840 board feet per acre (Scribner rule) at 160 years. On the basis of a 50-year curve, the mean site index is 70.

The main limitations affecting timber production are compaction, seedling mortality, and plant competition. Conventional methods of harvesting timber generally are suitable, but the soil may be compacted if it is moist when heavy equipment is used. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Erosion can be controlled by carefully planning the construction and maintenance of logging roads, skid trails, and landings. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

The vegetative site is Douglas Fir-Mixed Pine-Fescue Forest.

158B—Ruch gravelly silt loam, 2 to 7 percent slopes. This very deep, well drained soil is on alluvial fans. It formed in alluvium derived dominantly from metamorphic rock. Elevation is 1,000 to 3,000 feet. The mean annual precipitation is 20 to 35 inches, the mean annual temperature is 50 to 54 degrees F, and the average frost-free period is 140 to 180 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is dark brown gravelly silt loam about 7 inches thick. The upper 10 inches of the subsoil is reddish brown loam. The lower 53 inches is yellowish red loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is cobbly or stony.

Included in this unit are small areas of Camas, Evans, and Newberg soils on flood plains; Gregory soils near drainageways; Selmac soils on concave slopes; Coleman, Foehlin, and Medford soils on terraces; and Abegg, Manita, Shefflein, and Vannoy soils. Also included are small areas of Xerorthents, small areas of Dumps, and small areas of Ruch soils that have slopes of more than 7 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately slow in the Ruch soil. Available water capacity is about 8 inches. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for irrigated crops, such as alfalfa hay, small grain, and tree fruit. Other crops include corn for silage and grass-legume hay. Some areas are used for timber production, pasture, or homesite development.

This unit is well suited to irrigated crops. It is limited mainly by the moderately slow permeability and the gravelly surface layer, which may limit the use of some equipment and increase maintenance costs. In summer, irrigation is needed for the maximum production of most crops. Furrow, border, corrugation, trickle, and sprinkler irrigation systems are suitable. The system used generally is governed by the crop that is grown. For the efficient application and removal of surface irrigation water, land leveling is needed. To prevent overirrigation and excessive erosion, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. The use of pipe, ditch lining, or drop structures in irrigation ditches reduces water loss and the hazard of erosion.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Leaving crop residue on or near the surface helps to conserve moisture and control erosion.

A tillage pan forms easily if the soil is tilled when wet. Chiseling or subsoiling breaks up the pan. Surface crusting and compaction can be minimized by returning crop residue to the soil.

Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

Solid-set sprinkler irrigation is the best method of controlling frost and providing adequate moisture for tree fruit. Compaction can be minimized by limiting the use of equipment when the soil is wet. A permanent cover crop helps to control runoff and erosion.

This unit is well suited to homesite development. It has few limitations. Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. Gravel and cobbles should be removed from disturbed areas, particularly areas used for lawns. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. In summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

This unit is suited to the production of ponderosa pine and Douglas fir. Other species that grow on this unit include incense cedar, sugar pine, and Pacific madrone. The understory vegetation includes deerbrush, tall Oregon grape, and western fescue.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 115. The yield at culmination of the mean annual increment is 5,280 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 56,780 board feet per acre (Scribner rule) at 110 years.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 90. The yield at culmination of the mean annual increment is 4,200 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 31,840 board feet per acre (Scribner rule) at 160 years. On the basis of a 50-year curve, the mean site index is 70.

The main limitations affecting timber production are compaction, seedling mortality, and plant competition. Conventional methods of harvesting timber generally are suitable, but the soil may be compacted if it is moist when heavy equipment is used. Puddling can occur when the soil is wet. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface.

Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Erosion can be controlled by carefully planning the construction and maintenance of logging roads, skid trails, and landings. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. The large number of rock fragments in some areas also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

The vegetative site is Douglas Fir-Mixed Pine-Fescue Forest.

158D—Ruch gravelly silt loam, 7 to 20 percent slopes. This very deep, well drained soil is on alluvial fans and foot slopes. It formed in alluvium derived dominantly from metamorphic rock. Elevation is 1,000 to 3,000 feet. The mean annual precipitation is 20 to 35 inches, the mean annual temperature is 50 to 54 degrees F, and the average frost-free period is 140 to 180 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is dark brown gravelly silt loam about 7 inches thick. The upper 10 inches of the subsoil is reddish brown loam. The lower 53 inches is yellowish red loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is cobbly or stony.

Included in this unit are small areas of Gregory soils near drainageways; Selmac soils on concave slopes; Vannoy and Voorhies soils on ridges and convex slopes; Coleman, Foehlin, and Medford soils on terraces; and Abegg, Manita, and Shefflein soils. Also included are small areas of Xerorthents, small areas of Dumps, and small areas of Ruch soils that have slopes of more than 7 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately slow in the Ruch soil. Available water capacity is about 8 inches. The effective rooting depth is 60 inches or more. Runoff is slow or medium, and the hazard of water erosion is slight or moderate.

This unit is used mainly for irrigated crops, such as alfalfa hay, small grain, tree fruit, and grass-legume hay. It also is used for timber production, pasture, and homesite development.

This unit is suited to irrigated crops. It is limited mainly by the slope, the moderately slow permeability, and the gravelly surface layer, which may limit the use of some equipment and increase maintenance costs. In summer, irrigation is needed for the maximum production of most crops. Because of the slope, sprinkler and trickle irrigation systems are the best methods of applying water. These systems permit an even, controlled application of water, help to prevent excessive runoff, and minimize the risk of erosion. To prevent overirrigation and excessive erosion, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Leaving crop residue on or near the surface helps to conserve moisture and control erosion.

A tillage pan forms easily if the soil is tilled when wet. Chiseling or subsoiling breaks up the pan. Surface crusting and compaction can be minimized by returning crop residue to the soil.

The hazard of erosion can be reduced if fall grain is seeded early, stubble-mulch tillage is used, and tillage and seeding are on the contour or across the slope. Also, waterways should be shaped and seeded to perennial grasses.

Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

Solid-set sprinkler irrigation is the best method of controlling frost and providing adequate moisture for tree fruit. Compaction can be minimized by limiting the use of equipment when the soil is wet. A permanent cover crop helps to control runoff and erosion.

The main limitation affecting homesite development is the slope. Erosion is a hazard on the steeper slopes. Only the part of the site that is used for construction should be disturbed. Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. Gravel and cobbles should be removed from disturbed areas, particularly areas used for lawns. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

This unit is suited to the production of ponderosa pine and Douglas fir. Other species that grow on this unit include incense cedar, sugar pine, and Pacific madrone. The understory vegetation includes deerbrush, tall Oregon grape, and western fescue.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 115. The yield at culmination of the mean annual increment is 5,280 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 56,780 board feet per acre (Scribner rule) at 110 years.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 90. The yield at culmination of the mean annual increment is 4,200 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 31,840 board feet per acre (Scribner rule) at 160 years. On the basis of a 50-year curve, the mean site index is 70.

The main limitations affecting timber production are erosion, compaction, seedling mortality, and plant competition. Conventional methods of harvesting timber generally are suitable, but the soil may be compacted if it is moist when heavy equipment is used. Puddling can occur when the soil is wet. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Erosion can be controlled by carefully planning the construction and maintenance of logging roads, skid trails, and landings. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. The large number of rock fragments in some areas also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

The vegetative site is Douglas Fir-Mixed Pine-Fescue Forest.

159C—Rustlerpeak gravelly loam, 3 to 12 percent slopes. This moderately deep, well drained soil is on plateaus. It formed in colluvium derived from andesite and volcanic ash. Elevation is 4,000 to 6,100 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 40 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is dark reddish brown gravelly loam about 12 inches thick. The subsoil is dark reddish brown very cobbly clay loam about 11 inches thick. Weathered bedrock is at a depth of about 23 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Included in this unit are small areas of Snowlin soils on concave slopes, poorly drained soils near drainageways and on concave slopes, Woodseye soils and Rock outcrop on convex slopes, and soils that are similar to the Rustlerpeak soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Rustlerpeak soils that have slopes of less than 3 or more than 12 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderately slow in the Rustlerpeak soil. Available water capacity is about 5 inches. The effective rooting depth is 20 to 40 inches. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of white fir. Other species that grow on this unit include Douglas fir, incense cedar and Rocky Mountain maple. The understory vegetation includes cascade Oregongrape, western white anemone, and gooseberry.

On the basis of a 50-year site curve, the mean site index for white fir is 75. The yield at culmination of the mean annual increment is 12,530 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years.

The main limitations affecting timber production are compaction, erosion, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Conventional methods of harvesting timber generally are suitable, but the soil may be compacted if it is moist when heavy equipment is used. Puddling can occur when the soil is wet. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Erosion can be controlled by carefully planning the construction and maintenance of logging roads, skid trails, and landings. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Severe frost can damage or kill seedlings. Air drainage is restricted on this unit. Proper timber harvesting methods can reduce the effect of frost on regeneration. Reforestation can be accomplished by planting seedlings of frost-tolerant species, such as ponderosa pine and lodgepole pine.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

The main limitation affecting livestock grazing is compaction. The native vegetation suitable for grazing includes Canada bluegrass, Alaska oniongrass, and mountain brome. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion. The seedling survival rate may be low, however, because of cold temperatures in spring.

The vegetative site is White Fir Forest.

160E—Rustlerpeak gravelly loam, 12 to 35 percent north slopes. This moderately deep, well drained soil is on hillslopes. It formed in colluvium derived from andesite and volcanic ash. Elevation is 4,000 to 6,100 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 40 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is dark reddish brown gravelly loam about 12 inches thick. The subsoil is dark reddish brown very cobbly clay loam about 11 inches thick. Weathered bedrock is at a depth of about 23 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Included in this unit are small areas of Snowlin soils on concave slopes, poorly drained soils near drainageways and on concave slopes, Woodseye soils and Rock outcrop on ridges and convex slopes, and soils that are similar to the Rustlerpeak soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Rustlerpeak soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderately slow in the Rustlerpeak soil. Available water capacity is about 5 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of white fir. Other species that grow on this unit include Douglas fir, incense cedar and Rocky Mountain maple. The understory vegetation includes cascade Oregongrape, western white anemone, and gooseberry.

On the basis of a 50-year site curve, the mean site index for white fir is 75. The yield at culmination of the mean annual increment is 12,530 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years.

The main limitations affecting timber production are erosion, compaction, plant competition, and seedling mortality. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting ponderosa pine and Douglas fir seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

Severe frost can damage or kill seedlings. In the less sloping areas where air drainage may be restricted, proper timber harvesting methods can reduce the effect of frost on regeneration.

The main limitations affecting livestock grazing are compaction and erosion. The native vegetation suitable for grazing includes Canada bluegrass, Alaska oniongrass, and mountain brome. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion. The seedling survival rate may be low, however, because of cold temperatures in spring.

The vegetative site is White Fir Forest.

160G—Rustlerpeak gravelly loam, 35 to 65 percent north slopes. This moderately deep, well drained soil is on hillslopes. It formed in colluvium derived from andesite and volcanic ash. Elevation is 4,000 to 6,100 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 40 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is dark reddish brown gravelly loam about 12 inches thick. The subsoil is dark reddish brown very cobbly clay loam about 11 inches thick. Weathered bedrock is at a depth of about 23 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Included in this unit are small areas of Snowlin soils on concave slopes and on the less sloping parts of the landscape, Woodseye soils and Rock outcrop on ridges and convex slopes, and soils that are similar to the Rustlerpeak soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Rustlerpeak soils that have slopes of less than 35 or more than 65 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderately slow in the Rustlerpeak soil. Available water capacity is about 5 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of white fir. Other species that grow on this unit include Douglas fir, incense cedar and Rocky Mountain maple. The understory vegetation includes cascade Oregongrape, western white anemone, and gooseberry.

On the basis of a 50-year site curve, the mean site index for white fir is 75. The yield at culmination of the mean annual increment is 12,530 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years.

The main limitations affecting timber production are the slope, erosion, compaction, plant competition, and seedling mortality. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Building the roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting ponderosa pine and Douglas fir seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

Severe frost can damage or kill seedlings. Proper timber harvesting methods can reduce the effect of frost on regeneration.

The main limitations affecting livestock grazing are erosion, compaction, and the slope. The native vegetation suitable for grazing includes Canada bluegrass, Alaska oniongrass, and mountain brome. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock. Because of the slope and the Rock outcrop, areas of this unit can hinder livestock movement.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion. The seedling survival rate may be limited, however, because of cold temperatures in spring.

The vegetative site is White Fir Forest.

161G—Rustlerpeak-Rock outcrop complex, 35 to 70 percent north slopes. This map unit is on hillslopes. Elevation is 4,000 to 6,100 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 40 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

This unit is about 70 percent Rustlerpeak soil and 20 percent Rock outcrop. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Snowlin soils on concave slopes and on the less sloping parts of the landscape, Woodseye soils on ridges and convex slopes, and soils that are similar to the Rustlerpeak soil but have bedrock at a depth of less than 20 or more than 40 inches. Also included are small areas of Rustlerpeak soils that have slopes of less than 35 or more than 70 percent. Included areas make up about 10 percent of the total acreage.

The Rustlerpeak soil is moderately deep and well drained. It formed in colluvium derived dominantly from andesite and volcanic ash. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is dark reddish brown gravelly loam about 12 inches thick. The subsoil is dark reddish brown very cobbly clay loam about 11 inches thick. Weathered bedrock is at a depth of about 23 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Permeability is moderately slow in the Rustlerpeak soil. Available water capacity is about 5 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

Rock outcrop consists of areas of exposed bedrock. Runoff is very rapid in these areas.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of white fir. Other species that grow on this unit include Douglas fir, incense cedar, and Rocky Mountain maple. The understory vegetation includes cascade Oregongrape, western white anemone, and gooseberry.

On the basis of a 50-year site curve, the mean site index for white fir is 75. The yield at culmination of the mean annual increment is 12,530 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years.

The main limitations affecting timber production are the slope, the Rock outcrop, erosion, compaction, plant competition, and seedling mortality. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. The Rock outcrop can cause breakage of falling timber and can hinder yarding. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Building the roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting ponderosa pine and Douglas fir seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

Severe frost can damage or kill seedlings. Proper timber harvesting methods can reduce the effect of frost on regeneration.

The main limitations affecting livestock grazing are erosion, compaction, the slope, and the Rock outcrop. The native vegetation suitable for grazing includes Canada bluegrass, Alaska oniongrass, and mountain brome. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion. The seedling survival rate may be limited, however, because of cold temperatures in spring.

The vegetative site is White Fir Forest.

162B—Selmac loam, 2 to 7 percent slopes. This very deep, moderately well drained soil is in basins. It formed in alluvium derived dominantly from sedimentary and volcanic rock and underlain by clayey sediment. Elevation is 1,000 to 3,000 feet. The mean annual precipitation is 25 to 40 inches, the mean annual temperature is 50 to 54 degrees F, and the average frost-free period is 140 to 180 days. The native vegetation is mainly hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is dark brown loam about 17 inches thick. The subsoil is reddish brown clay loam about 12 inches thick. The substratum to a depth of 60 inches is olive brown clay. The depth to bedrock is 60 inches or more.

Included in this unit are small areas of Darow, Manita, and Vannoy soils on hillslopes; Debenger and Ruch soils on convex slopes; Langellain soils; and Gregory soils and poorly drained or very poorly drained, loamy soils near drainageways and on concave slopes. Also included are small areas of Selmac soils that have slopes of more than 7 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderately slow to a depth of 29 inches in the Selmac soil and very slow below that depth. Available water capacity is about 8 inches. The effective rooting depth is limited by the dense, clayey substratum, which is at a depth of 12 to 36 inches. Runoff is slow, and the hazard of water erosion is slight. The water table, which is perched above the layer of clay, is at a depth of 1.5 to 3.0 feet from December through May.

This unit is used mainly for hay and pasture. It also is used for small grain, tree fruit, and homesite development.

This unit is suited to irrigated crops. It is limited mainly by wetness in winter and spring and the very slow permeability. Crops that require good drainage can be grown if a properly designed tile drainage system is installed. Tile drainage can lower the water table if collection laterals are closely spaced and a suitable outlet is available. Land smoothing and open ditches can reduce surface wetness.

In summer, irrigation is needed for the maximum production of most crops. Furrow, border, corrugation, trickle, and sprinkler irrigation systems are suitable. The system used generally is governed by the crop that is grown. For the efficient application and removal of surface irrigation water, land leveling is needed. To prevent overirrigation and the development of a perched water table, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. The use of pipe, ditch lining, or drop structures in irrigation ditches reduces water loss and the hazard of erosion.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Leaving crop residue on or near the surface helps to conserve moisture and control erosion.

A tillage pan forms easily if the soil is tilled when wet. Chiseling or subsoiling breaks up the pan. Surface crusting and compaction can be minimized by returning crop residue to the soil.

Solid-set sprinkler irrigation is the best method of controlling frost and providing adequate moisture for tree fruit. Compaction can be minimized by limiting the use of equipment when the soil is wet. A permanent cover crop helps to control runoff and erosion.

Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

The main limitations affecting homesite development are the wetness, the very slow permeability, a high shrink-swell potential, and low strength.

The very slow permeability and the seasonal high water table increase the possibility that septic tank absorption fields will fail. Interceptor ditches can divert subsurface water and thus improve the efficiency of the absorption fields. Alternative waste disposal systems may function properly on this unit. Suitable included soils are throughout the unit. Onsite investigation is needed to locate such soils.

Because the seasonal high water table is perched above the layer of clay, a drainage system is needed on sites for buildings with basements and crawl spaces. The wetness can be reduced by installing drainage tile around footings. Properly designing foundations and footings, diverting runoff away from the buildings, and backfilling with material that has a low shrink-swell potential help to prevent the structural damage caused by shrinking and swelling. Properly designing buildings and roads helps to offset the limited ability of the soil to support a load.

Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. In many areas it may be necessary to haul in topsoil for lawns and gardens. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

The vegetative site is Loamy Hills, 20- to 35-inch precipitation zone.

162D—Selmac loam, 7 to 20 percent slopes. This very deep, moderately well drained soil is in basins. It formed in alluvium derived dominantly from sedimentary and volcanic rock and underlain by clayey sediment. Elevation is 1,000 to 3,000 feet. The mean annual precipitation is 25 to 40 inches, the mean annual temperature is 50 to 54 degrees F, and the average frost-free period is 140 to 180 days. The native vegetation is mainly hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is dark brown loam about 17 inches thick. The subsoil is reddish brown clay loam about 12 inches thick. The substratum to a depth of 60 inches is olive brown clay. The depth to bedrock is 60 inches or more.

Included in this unit are small areas of Darow, Manita, and Vannoy soils on hillslopes; Debenger and Ruch soils on convex slopes; Langellain soils; and Gregory soils and poorly drained or very poorly drained, loamy soils near drainageways and on concave slopes. Also included are small areas of Selmac soils that have slopes of less than 7 or more than 20 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderately slow to a depth of 29 inches in the Selmac soil and very slow below that depth. Available water capacity is about 8 inches. The effective rooting depth is limited by the dense, clayey substratum, which is at a depth of 12 to 36 inches. Runoff is medium, and the hazard of water erosion is moderate. The water table, which is perched above the layer of clay, is at a depth of 1.5 to 3.0 feet from December through May.

This unit is used mainly for hay and pasture. It also is used for tree fruit, small grain, and homesite development.

This unit is suited to irrigated crops. It is limited mainly by wetness in winter and spring, the very slow permeability, and the slope. Crops that require good drainage can be grown if a properly designed drainage system is installed. The ability of tile drains to remove subsurface water from the soil is limited because of the slope and the very slow permeability in the substratum. Wetness can be reduced by interceptor drains. Open ditches can reduce surface wetness.

In summer, irrigation is needed for the maximum production of most crops. Because of the slope, sprinkler irrigation is the best method of applying water. This method permits an even, controlled application of water, helps to prevent excessive runoff, and minimizes the risk of erosion. To prevent overirrigation and excessive erosion, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Leaving crop residue on or near the surface helps to conserve moisture and control erosion.

A tillage pan forms easily if the soil is tilled when wet. Chiseling or subsoiling breaks up the pan. Surface crusting and compaction can be minimized by returning crop residue to the soil.

The hazard of erosion can be reduced if fall grain is seeded early, stubble-mulch tillage is used, and tillage and seeding are on the contour or across the slope. Also, waterways should be shaped and seeded to perennial grasses.

Seedbeds should be prepared on the contour or across the slope where practical. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

Solid-set sprinkler irrigation is the best method of controlling frost and providing adequate moisture for tree fruit. Compaction can be minimized by limiting the use of equipment when the soil is wet. A permanent cover crop helps to control runoff and erosion.

The main limitations affecting homesite development are the wetness, the very slow permeability, a high shrink-swell potential, and the slope.

The very slow permeability and the seasonal high water table increase the possibility that septic tank absorption fields will fail. Interceptor ditches can divert subsurface water and thus improve the efficiency of the absorption fields. Alternative waste disposal systems may function properly on this unit. Suitable included soils are throughout the unit. Onsite investigation is needed to locate such soils.

Because the seasonal high water table is perched above the layer of clay, a drainage system is needed on sites for buildings with basements and crawl spaces. The wetness can be reduced by installing drainage tile around footings. Properly designing foundations and footings, diverting runoff away from the buildings, and backfilling with material that has a low shrink-swell potential help to prevent the structural damage caused by shrinking and swelling. Properly designing buildings and roads helps to offset the limited ability of the soil to support a load.

Erosion is a hazard on the steeper slopes. Only the part of the site that is used for construction should be disturbed. Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. In many areas it may be necessary to haul in topsoil for lawns and gardens. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

The vegetative site is Loamy Hills, 20- to 35-inch precipitation zone.

163A—Sevenoaks loamy sand, 0 to 3 percent slopes. This very deep, somewhat excessively drained soil is on stream terraces. It formed in alluvium derived from mixed sources and containing various amounts of pumice and volcanic ash. Elevation is 1,000 to 1,500 feet. The mean annual precipitation is 18 to 25 inches, the mean annual temperature is 50 to 54 degrees F, and the average frost-free period is 150 to 180 days. The vegetation in areas that have not been cultivated is mainly hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is very dark brown loamy sand about 14 inches thick. The next layer is dark brown gravelly sand about 8 inches thick. The substratum to a depth of 60 inches is dark grayish brown and olive brown gravelly coarse sand and gravelly sand. In some areas the surface layer is sandy loam.

Included in this unit are small areas of Central Point, Medford, and Takilma soils; Gregory soils on concave slopes; and Sevenoaks soils that have slopes of more than 3 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderately rapid in the Sevenoaks soil. Available water capacity is about 6 inches. The effective rooting depth is 60 inches or more. The substratum can restrict the penetration of roots, however, because of droughtiness. Runoff is slow, and the hazard of water erosion is slight.

This unit is used mainly for irrigated crops, such as alfalfa hay, tree fruit, and small grain. Other crops include corn for silage. Some areas are used for grass hay, pasture, or homesite development.

This unit is suited to irrigated crops. It is limited mainly by a rapid rate of water intake and droughtiness. In summer, irrigation is needed for the maximum production of most crops. Because the rate of water intake is rapid, sprinkler and trickle irrigation systems are the best methods of applying water. These systems permit an even, controlled application of water, help to prevent excessive runoff, and minimize the risk of erosion. To prevent overirrigation and the leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. Because the soil is droughty, the applications should be light and frequent.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Leaving crop residue on or near the surface helps to conserve moisture and control soil blowing.

Solid-set sprinkler irrigation is the best method of controlling frost and providing adequate moisture for tree fruit. Compaction can be minimized by limiting the use of equipment when the soil is wet and by planting a cover crop. A permanent cover crop helps to control runoff and erosion.

Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

This unit is suited to homesite development. The main limitations are the moderately rapid permeability and droughtiness.

This unit is poorly suited to standard systems of waste disposal because of the moderately rapid permeability. Alternative waste disposal systems may function properly on this unit. Suitable included soils are throughout the unit. Onsite investigation is needed to locate such soils.

In some areas excavation for houses and access roads exposes material that is highly susceptible to soil blowing. Revegetating as soon as possible in disturbed areas around construction sites helps to control soil blowing. Cutbanks are not stable and are subject to slumping. To keep cutbanks from caving in, excavations may require special retainer walls.

Establishing plants is difficult in areas where the surface layer has been removed. Mulching and applying fertilizer help to establish plants in cut areas. In many areas it may be necessary to haul in topsoil for lawns and gardens. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

The vegetative site is Deep Loamy Terrace, 18- to 28-inch precipitation zone.

164B—Shefflein loam, 2 to 7 percent slopes. This deep, well drained soil is on alluvial fans. It formed in alluvium derived dominantly from granitic rock. Elevation is 1,000 to 4,000 feet. The mean annual precipitation is 25 to 40 inches, the mean annual temperature is 46 to 54 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is dark brown loam about 4 inches thick. The next layer is reddish brown loam about 6 inches thick. The upper 30 inches of the subsoil is reddish brown clay loam. The lower 16 inches is reddish brown sandy clay loam. Weathered bedrock is at a depth of about 56 inches. The depth to bedrock ranges from 40 to 60 inches. In some areas the surface layer is sandy loam or clay loam.

Included in this unit are small areas of Clawson and Kubli soils near drainageways and on concave slopes; Barron, Manita, and Ruch soils; and soils that are similar to the Shefflein soil but have bedrock at a depth of more than 60 inches. Also included are small areas of Shefflein soils that have slopes of more than 7 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately slow in the Shefflein soil. Available water capacity is about 8 inches. The effective rooting depth is 40 to 60 inches. Runoff is slow, and the hazard of water erosion is moderate.

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

This unit is well suited to irrigated crops. It is limited mainly by the moderately slow permeability and the hazard of erosion. In summer, irrigation is needed for the maximum production of most crops. Sprinkler irrigation is the best method of applying water. This method permits an even, controlled application of water, helps to prevent excessive runoff, and minimizes the risk of erosion. Border and contour flood irrigation systems also are suitable. For the efficient application and removal of surface irrigation water, land leveling is needed. To prevent overirrigation and excessive erosion, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. The use of pipe, ditch lining, or drop structures in irrigation ditches reduces water loss and the hazard of erosion.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Leaving crop residue on or near the surface helps to conserve moisture and control erosion.

A tillage pan forms easily if the soil is tilled when wet. Chiseling or subsoiling breaks up the pan. Surface crusting and compaction can be minimized by returning crop residue to the soil.

Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

This unit is well suited to homesite development. The main limitations are the moderately slow permeability and the shrink-swell potential. The moderately slow permeability can be overcome by increasing the size of the absorption field.

If buildings are constructed on this unit, properly designing foundations and footings, diverting runoff away from the buildings, and backfilling with material that has a low shrink-swell potential help to prevent the structural damage caused by shrinking and swelling. Properly designing buildings and roads helps to offset the limited ability of the soil to support a load.

Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

This unit is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include incense cedar, sugar pine, and Pacific madrone. The understory vegetation includes deerbrush, tall Oregon grape, and western fescue.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 115. The yield at culmination of the mean annual increment is 5,280 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 56,780 board feet per acre (Scribner rule) at 110 years.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 105. The yield at culmination of the mean annual increment is 5,460 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 45,600 board feet per acre (Scribner rule) at 150 years. On the basis of a 50-year curve, the mean site index is 75.

The main limitations affecting timber production are compaction, seedling mortality, and plant competition. When timber is harvested, management that minimizes the risk of erosion is essential. Conventional methods of harvesting timber generally are suitable, but the soil may be compacted if it is moist when heavy equipment is used. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Erosion can be controlled by carefully planning the construction and maintenance of logging roads, skid trails, and landings. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

Increased erosion, loss of plant nutrients, and water repellency are likely to result from fires of moderate intensity.

The vegetative site is Douglas Fir-Mixed Pine-Fescue Forest.

164D—Shefflein loam, 7 to 20 percent slopes. This deep, well drained soil is on alluvial fans. It formed in alluvium derived dominantly from granitic rock.

Elevation is 1,000 to 4,000 feet. The mean annual precipitation is 25 to 40 inches, the mean annual temperature is 46 to 54 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is dark brown loam about 4 inches thick. The next layer is reddish brown loam about 6 inches thick. The upper 30 inches of the subsoil is reddish brown clay loam. The lower 16 inches is reddish brown sandy clay loam. Weathered bedrock is at a depth of about 56 inches. The depth to bedrock ranges from 40 to 60 inches. In some areas the surface layer is sandy loam or clay loam or is stony.

Included in this unit are small areas of Clawson and Kubli soils near drainageways and on concave slopes; Tallowbox soils on the more sloping parts of the landscape; Barron, Manita, and Ruch soils; and soils that are similar to the Shefflein soil but have bedrock at a depth of less than 40 or more than 60 inches. Also included are small areas of Shefflein soils that have slopes of less than 7 or more than 20 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately slow in the Shefflein soil. Available water capacity is about 8 inches. The effective rooting depth is 40 to 60 inches. Runoff is medium, and the hazard of water erosion is moderate or high.

This unit is used mainly for timber production or wildlife habitat. It also is used for hay and pasture and for homesite development.

This unit is suited to irrigated crops. It is limited mainly by the slope, the hazard of erosion, and the moderately slow permeability. In summer, irrigation is needed for the maximum production of most crops. Because of the slope, sprinkler irrigation is the best method of applying water. This method permits an even, controlled application of water, helps to prevent excessive runoff, and minimizes the risk of erosion. To prevent overirrigation and excessive erosion, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Leaving crop residue on or near the surface helps to conserve moisture and control erosion.

A tillage pan forms easily if the soil is tilled when wet. Chiseling or subsoiling breaks up the pan. Surface crusting and compaction can be minimized by returning crop residue to the soil.

Seedbeds should be prepared on the contour or across the slope where practical. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

The main limitations affecting homesite development are the moderately slow permeability, the shrink-swell potential, and the slope. The moderately slow permeability can be overcome by increasing the size of the absorption field.

If buildings are constructed on this unit, properly designing foundations and footings, diverting runoff away from the buildings, and backfilling with material that has a low shrink-swell potential help to prevent the structural damage caused by shrinking and swelling. Properly designing buildings and roads helps to offset the limited ability of the soil to support a load.

Erosion is a hazard on the steeper slopes. Only the part of the site that is used for construction should be disturbed. Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

This unit is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include incense cedar, sugar pine, and Pacific madrone. The understory vegetation includes deerbrush, tall Oregon grape, and western fescue.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 115. The yield at culmination of the mean annual increment is 5,280 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 56,780 board feet per acre (Scribner rule) at 110 years.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 105. The yield at culmination of the mean annual increment is 5,460 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 45,600 board feet per acre (Scribner rule) at 150 years. On the basis of a 50-year curve, the mean site index is 75.

The main limitations affecting timber production are erosion, compaction, seedling mortality, and plant competition. When timber is harvested, management that minimizes the risk of erosion is essential. Conventional methods of harvesting timber generally are suitable, but the soil may be compacted if it is moist when heavy equipment is used. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Erosion can be controlled by carefully planning the construction and maintenance of logging roads, skid trails, and landings. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

Increased erosion, loss of plant nutrients, and water repellency are likely to result from fires of moderate intensity.

The vegetative site is Douglas Fir-Mixed Pine-Fescue Forest.

165E—Shefflein loam, 20 to 35 percent north slopes. This deep, well drained soil is on hillslopes. It formed in colluvium and residuum derived from granitic rock. Elevation is 1,000 to 4,000 feet. The mean annual precipitation is 25 to 40 inches, the mean annual temperature is 46 to 54 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is dark brown loam about 4 inches thick. The next layer is reddish brown loam about 6 inches thick. The upper 30 inches of the subsoil is reddish brown clay loam. The lower 16 inches is reddish brown sandy clay loam. Weathered bedrock is at a depth of about 56 inches. The depth to bedrock ranges from 40 to 60 inches. In some areas the surface layer is sandy loam or clay loam.

Included in this unit are small areas of Ruch, Vannoy, and Voorhies soils; Tallowbox soils on the more sloping parts of the landscape and on convex slopes; poorly drained soils near drainageways and on concave slopes; and soils that are similar to the Shefflein soil but have bedrock at a depth of more than 60 inches. Also included are small areas of Shefflein soils that have slopes of less than 20 or more than 35 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately slow in the Shefflein soil. Available water capacity is about 8 inches. The effective rooting depth is 40 to 60 inches. Runoff is medium, and the hazard of water erosion is high.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include incense cedar, sugar pine, and Pacific madrone. The understory vegetation includes deerbrush, tall Oregon grape, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 110. The yield at culmination of the mean annual increment is 5,880 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 48,300 board feet per acre (Scribner rule) at 140 years. On the basis of a 50-year curve, the mean site index is 80.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 115. The yield at culmination of the mean annual increment is 5,280 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 56,780 board feet per acre (Scribner rule) at 110 years.

The main limitations affecting timber production are erosion, compaction, plant competition, and seedling mortality. When timber is harvested, management that minimizes the risk of erosion is essential. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded

Figure 11.—Severely eroded roadcut in an area of Shefflein loam, 20 to 35 percent north slopes.

unless they are treated (fig. 11). Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

This unit is subject to slumping, especially in areas adjacent to drainageways. Road failure and landslides are likely to occur after road construction and clearcutting. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings.

Increased erosion, loss of plant nutrients, and water repellency are likely to result from fires of moderate intensity.

The vegetative site is Douglas Fir-Mixed Pine-Fescue Forest.

166E—Shefflein loam, 20 to 35 percent south slopes. This deep, well drained soil is on hillslopes. It formed in colluvium and residuum derived from granitic rock. Elevation is 1,000 to 4,000 feet. The mean annual precipitation is 25 to 40 inches, the mean annual temperature is 46 to 54 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is dark brown loam about 4 inches thick. The next layer is reddish brown loam about 6 inches thick. The upper 30 inches of the subsoil is reddish brown clay loam. The lower 16 inches is reddish brown sandy clay loam. Weathered bedrock is at a depth of about 56 inches. The depth to bedrock ranges from 40 to 60 inches. In some areas the surface layer is sandy loam or clay loam or is stony.

Included in this unit are small areas of Ruch, Vannoy, and Voorhies soils; Tallowbox soils on the more sloping parts of the landscape and on convex slopes; and soils that are similar to the Shefflein soil but have bedrock at a depth of less than 40 or more than 60 inches. Also included are small areas of poorly drained soils near drainageways and on concave slopes and Shefflein soils that have slopes of less than 20 or more than 35 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately slow in the Shefflein soil. Available water capacity is about 8 inches. The effective rooting depth is 40 to 60 inches. Runoff is medium, and the hazard of water erosion is high.

This unit is used for timber production and wildlife habitat. It is suited to the production of ponderosa pine and Douglas fir. Other species that grow on this unit include incense cedar, sugar pine, and Pacific madrone. The understory vegetation includes deerbrush, tall Oregon grape, and Idaho fescue.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 100. The yield at culmination of the mean annual increment is 4,080 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 44,640 board feet per acre (Scribner rule) at 120 years.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 100. The yield at culmination of the mean annual increment is 5,040 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 39,750 board feet per acre (Scribner rule) at 150 years. On the basis of a 50-year curve, the mean site index is 70.

The main limitations affecting timber production are erosion, compaction, seedling mortality, and plant competition. When timber is harvested, management that minimizes the risk of erosion is essential. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

This unit is subject to slumping, especially in areas adjacent to drainageways. Road failure and landslides are likely to occur after road construction and clearcutting. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced by providing artificial shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied (fig. 12). Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

Increased erosion, loss of plant nutrients, and water repellency are likely to result from fires of moderate intensity.

Figure 12.—Competing plants in a burned area of Shefflein loam, 20 to 35 percent south slopes. Whiteleaf manzanita is in the foreground.

The vegetative site is Mixed Pine-Douglas Fir-Fescue Forest, Granitic.

167B—Sibannac silt loam, 0 to 7 percent slopes. This very deep, poorly drained soil is in basins. It formed in alluvium derived dominantly from andesite, tuff, and breccia. Elevation is 3,600 to 5,800 feet. The mean annual precipitation is 30 to 40 inches, the mean annual temperature is 40 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly grasses, sedges, and forbs.

Typically, the surface layer is black silt loam about 6 inches thick. The next layer is black silty clay loam about 5 inches thick. The subsoil is very dark gray and very dark grayish brown clay loam about 21 inches thick. The substratum to a depth of 60 inches is very dark grayish brown and black clay loam. The depth to bedrock is 60 inches or more.

Included in this unit are small areas of Bybee, Farva, Kanutchan, Pinehurst, Rustlerpeak, Snowlin, and Tatouche soils; very poorly drained, organic soils; and Sibannac soils that have slopes of more than 7 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately slow in the Sibannac soil. Available water capacity is about 12 inches. The effective rooting depth is limited by the water table, which is within a depth of 1 foot from January through June. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for pasture and wildlife habitat. The main limitations affecting livestock grazing are the seasonal wetness and compaction. The wetness limits the choice of suitable forage plants and the period of cutting or grazing and increases the risk of winterkill.

If the pasture is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. The grazing system should maintain the desired balance of species in the plant community. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth.

Tufted hairgrass is the native plant preferred for livestock grazing; however, this unit can be renovated and forage production increased by seeding other suitable grasses. The plants selected for seeding should be those that are tolerant of a cold climate and wetness. Fertilizer is needed to ensure the optimum growth of grasses. Grasses respond to nitrogen.

The vegetative site is Wet Meadow.

168G—Siskiyou gravelly sandy loam, 35 to 60 percent north slopes. This moderately deep, somewhat excessively drained soil is on hillslopes. It formed in colluvium derived from granitic rock. Elevation is 1,200 to 4,000 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles and twigs about 1 inch thick. The surface layer is dark brown gravelly sandy loam about 9 inches thick. The subsoil is olive brown sandy loam about 8 inches thick. The substratum is grayish brown sandy loam about 18 inches thick. Weathered bedrock is at a depth of about 35 inches. The depth to bedrock ranges from 20 to 40 inches.

Included in this unit are small areas of Beekman, Colestine, Josephine, and Speaker soils; Rock outcrop; soils that are similar to the Siskiyou soil but have bedrock at a depth of more than 40 inches; and, on ridges, soils that are similar to the Siskiyou soil but have bedrock at a depth of less than 20 inches. Also included are small areas of Siskiyou soils that have slopes of less than 35 or more than 60 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately rapid in the Siskiyou soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir. Other species that grow on this unit include ponderosa pine, sugar pine, and Pacific dogwood. The understory vegetation includes creambush oceanspray, California hazel, and common snowberry.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 115. The yield at culmination of the mean annual increment is 6,360 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 15,700 board feet per acre (Scribner rule) at 130 years. On the basis of a 50-year curve, the mean site index is 85.

The main limitations affecting timber production are the slope, erosion, compaction, plant competition, and seedling mortality. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

When timber is harvested, management that minimizes the risk of erosion is essential. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

This unit is subject to slumping, especially in areas adjacent to drainageways. Road failure and landslides are likely to occur after road construction and clearcutting.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Building the roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings.

Increased erosion, loss of plant nutrients, and water repellency are likely to result from fires of moderate intensity.

The vegetative site is Douglas Fir-Dogwood Forest, Granitic.

169G—Siskiyou gravelly sandy loam, 35 to 60 percent south slopes. This moderately deep, somewhat excessively drained soil is on hillslopes. It formed in colluvium derived from granitic rock. Elevation is 1,200 to 4,000 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles and twigs about 1 inch thick. The surface layer is dark brown gravelly sandy loam about 9 inches thick. The subsoil is olive brown sandy loam about 8 inches thick. The substratum is grayish brown sandy loam about 18 inches thick. Weathered bedrock is at a depth of about 35 inches. The depth to bedrock ranges from 20 to 40 inches.

Included in this unit are small areas of Beekman, Colestine, Josephine, and Speaker soils; Rock outcrop; soils that are similar to the Siskiyou soil but have bedrock at a depth of more than 40 inches; and, on ridges, soils that are similar to the Siskiyou soil but have bedrock within a depth of 20 inches. Also included are small areas of Siskiyou soils that have slopes of less than 35 or more than 60 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately rapid in the Siskiyou soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir. Other species that grow on this unit include ponderosa pine, sugar pine, and California black oak. The understory vegetation includes canyon live oak, deerbrush, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 110. The yield at culmination of the mean annual increment is 5,880 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 48,300 board feet per acre (Scribner rule) at 140 years. On the basis of a 50-year curve, the mean site index is 75.

The main limitations affecting timber production are the slope, erosion, compaction, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

When timber is harvested, management that minimizes the risk of erosion is essential. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

This unit is subject to slumping, especially in areas adjacent to drainageways. Road failure and landslides are likely to occur after road construction and clearcutting.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Building the roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced by providing artificial shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

Increased erosion, loss of plant nutrients, and water repellency are likely to result from fires of moderate intensity.

The vegetative site is Douglas Fir-Black Oak Forest.

170C—Skookum very cobbly loam, 1 to 12 percent slopes. This moderately deep, well drained soil is on hillslopes. It formed in residuum and colluvium derived dominantly from andesite, tuff, and breccia. Elevation is 2,000 to 4,000 feet. The mean annual precipitation is 20 to 35 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 150 days. The native vegetation is mainly grasses, shrubs, and forbs and a few scattered hardwoods.

Typically, the surface layer is very dark brown very cobbly loam about 3 inches thick. The next layer is very dark grayish brown very cobbly loam about 5 inches thick. The upper 8 inches of the subsoil is very dark grayish brown very cobbly clay loam. The lower 12 inches is dark brown very cobbly and extremely cobbly clay. Bedrock is at a depth of about 28 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Included in this unit are small areas of Lorella, McMullin, Randcore, and Shoat soils; Carney and Medco soils on concave slopes; McNull soils on north-facing slopes; poorly drained soils near drainageways and on concave slopes; and soils that are similar to the Skookum soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Skookum soils that have slopes of more than 12 percent. Included areas make up about 20 percent of the total acreage.

Permeability is slow in the Skookum soil. Available water capacity is about 2 inches. The effective rooting depth is 20 to 40 inches. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for livestock grazing and wildlife habitat. The main limitations affecting livestock grazing are compaction, cobbles and stones on the surface, and droughtiness. The vegetation suitable for grazing includes Idaho fescue, bluebunch wheatgrass, and pine bluegrass. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment. The use of ground equipment is limited in many areas by the cobbles and stones on the surface.

Range seeding is suitable if the site is in poor condition. The main limitations are droughtiness and the cobbles and stones on the surface. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the slope and the depth to bedrock.

The vegetative site is Droughty Slopes, 20- to 30-inch precipitation zone.

171E—Skookum-Bogus complex, 12 to 35 percent north slopes. This map unit is on hillslopes. Elevation is 3,000 to 4,400 feet. The mean annual precipitation is 18 to 25 inches, the mean annual temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 150 days. The native vegetation on the Skookum soil is mainly grasses, shrubs, and forbs and a few scattered hardwoods. That on the Bogus soil is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 50 percent Skookum soil and 30 percent Bogus soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Heppsie soils, Lorella soils and Rock outcrop on convex slopes, Carney soils on concave slopes, and poorly drained soils near drainageways and on concave slopes. Also included are small areas of soils that are similar to the Bogus soil but have bedrock within a depth of 60 inches, soils that are similar to the Skookum soil but have bedrock at a depth of more than 40 inches, and Bogus and Skookum soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 20 percent of the total acreage.

The Skookum soil is moderately deep and well drained. It formed in residuum and colluvium derived dominantly from andesite, tuff, and breccia. Typically, the surface layer is very dark brown very cobbly loam about 3 inches thick. The next layer is very dark grayish brown very cobbly loam about 5 inches thick. The upper 8 inches of the subsoil is very dark grayish brown very cobbly clay loam. The lower 12 inches is dark brown very cobbly and extremely cobbly clay. Bedrock is at a depth of about 28 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Permeability is slow in the Skookum soil. Available water capacity is about 2 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

The Bogus soil is very deep and well drained. It formed in residuum and colluvium derived dominantly from andesite, tuff, and breccia. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is black very gravelly loam about 7 inches thick. The next layer is very dark grayish brown very gravelly loam about 8 inches thick. The upper 6 inches of the subsoil is dark brown gravelly clay loam. The lower 44 inches is dark yellowish brown and dark brown clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is stony.

Permeability is slow in the Bogus soil. Available water capacity is about 8 inches. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used mainly for livestock grazing or wildlife habitat. The Bogus soil also is used for timber production.

The main limitations affecting livestock grazing are compaction, erosion, and the slope. The Skookum soil also is limited by cobbles and stones on the surface and by droughtiness. The vegetation suitable for grazing includes Idaho fescue, bluebunch wheatgrass, and pine bluegrass on the Skookum soil and western fescue, mountain brome, and tall trisetum on the Bogus soil. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment. The use of ground equipment is limited by the cobbles and stones on the surface of the Skookum soil and the slope.

This unit is poorly suited to range seeding. The main limitations are droughtiness and the cobbles and stones on the surface of the Skookum soil. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the slope of both soils and the depth to bedrock in the Skookum soil.

The Bogus soil is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include incense cedar, sugar pine, and California black oak. The understory vegetation includes tall Oregon grape, common snowberry, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 100 on the Bogus soil. The yield at culmination of the mean annual increment is 5,040 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 39,750 board feet per acre (Scribner rule) at 150 years. On the basis of a 50-year curve, the mean site index is 70.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 90 on the Bogus soil. The yield at culmination of the mean annual increment is 3,400 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 37,960 board feet per acre (Scribner rule) at 130 years.

The main limitations affecting timber production on the Bogus soil are erosion, compaction, seedling mortality, and plant competition. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. The large number of rock fragments in some areas also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. Reforestation can be accomplished by planting ponderosa pine and Douglas fir seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

The vegetative site in areas of the Skookum soil is Droughty Slopes, 20- to 30-inch precipitation zone, and the one in areas of the Bogus soil is Douglas Fir-Mixed Pine-Sedge Forest.

172E—Skookum-Bogus complex, 12 to 35 percent south slopes. This map unit is on hillslopes. Elevation is 3,000 to 4,400 feet. The mean annual precipitation is 18 to 25 inches, the mean annual temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 150 days. The native vegetation on the Skookum soil is mainly grasses, shrubs, and forbs and a few scattered hardwoods. That on the Bogus soil is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 55 percent Skookum soil and 25 percent Bogus soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Heppsie soils, Lorella soils and Rock outcrop on convex slopes, Carney soils on concave slopes, and poorly drained soils near drainageways and on concave slopes. Also included are small areas of soils that are similar to the Bogus soil but have bedrock within a depth of 60 inches, soils that are similar to the Skookum soil but have bedrock at a depth of more than 40 inches, and Bogus and Skookum soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 20 percent of the total acreage.

The Skookum soil is moderately deep and well drained. It formed in residuum and colluvium derived dominantly from andesite, tuff, and breccia. Typically, the surface layer is very dark brown very cobbly loam about 3 inches thick. The next layer is very dark grayish brown very cobbly loam about 5 inches thick. The upper 8 inches of the subsoil is very dark grayish brown very cobbly clay loam. The lower 12 inches is dark brown very cobbly and extremely cobbly clay. Bedrock is at a depth of about 28 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Permeability is slow in the Skookum soil. Available water capacity is about 2 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

The Bogus soil is very deep and well drained. It formed in residuum and colluvium derived dominantly from andesite, tuff, and breccia. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is black very gravelly loam about 7 inches thick. The next layer is very dark grayish brown very gravelly loam about 8 inches thick. The upper 6 inches of the subsoil is dark brown gravelly clay loam. The lower 44 inches is dark yellowish brown and dark brown clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is stony.

Permeability is slow in the Bogus soil. Available water capacity is about 8 inches. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used mainly for livestock grazing or wildlife habitat. The Bogus soil also is used for timber production.

The main limitations affecting livestock grazing are compaction, erosion, and the slope. The Skookum soil also is limited by cobbles and stones on the surface and by droughtiness. The vegetation suitable for grazing includes Idaho fescue, bluebunch wheatgrass, and pine bluegrass on the Skookum soil and western fescue, mountain brome, and tall trisetum on the Bogus soil. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment. The use of ground equipment on the Skookum soil is limited by the cobbles and stones on the surface and the slope.

This unit is poorly suited to range seeding. The main limitations are droughtiness and the cobbles and stones on the surface of the Skookum soil. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the slope of both soils and the depth to bedrock in the Skookum soil.

The Bogus soil is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include incense cedar, sugar pine, and California black oak. The understory vegetation includes tall Oregon grape, common snowberry, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 90 on the Bogus soil. The yield at culmination of the mean annual increment is 4,200 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 31,840 board feet per acre (Scribner rule) at 160 years. On the basis of a 50-year curve, the mean site index is 65.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 85 on the Bogus soil. The yield at culmination of the mean annual increment is 3,080 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 38,700 board feet per acre (Scribner rule) at 150 years.

The main limitations affecting timber production on the Bogus soil are erosion, compaction, seedling mortality, and plant competition. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. The large number of rock fragments in some areas also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. Reforestation can be accomplished by planting ponderosa pine and Douglas fir seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

The vegetative site in areas of the Skookum soil is Droughty Slopes, 20- to 30-inch precipitation zone, and the one in areas of the Bogus soil is Douglas Fir-Mixed Pine-Sedge Forest.

173D—Skookum-Rock outcrop-McMullin complex, 1 to 20 percent slopes. This map unit is on plateaus. Elevation is 2,000 to 4,000 feet. The mean annual precipitation is 20 to 35 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 150 days. The native vegetation is mainly grasses, shrubs, and forbs and a few scattered hardwoods.

This unit is about 60 percent Skookum soil, 15 percent Rock outcrop, and 15 percent McMullin soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Lorella, Randcore, and Shoat soils; Carney and Medco soils on concave slopes; McNull soils on north-facing slopes; poorly drained soils near drainageways and on concave slopes; and soils that are similar to the Skookum soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Skookum and McMullin soils that have slopes of more than 20 percent. Included areas make up about 10 percent of the total acreage.

The Skookum soil is moderately deep and well drained. It formed in residuum and colluvium derived dominantly from andesite, tuff, and breccia. Typically, the surface layer is very dark brown very cobbly loam about 3 inches thick. The next layer is very dark grayish brown very cobbly loam about 5 inches thick. The upper 8 inches of the subsoil is very dark grayish brown very cobbly clay loam. The lower 12 inches is dark brown very cobbly and extremely cobbly clay. Bedrock is at a depth of about 28 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Permeability is slow in the Skookum soil. Available water capacity is about 2 inches. The effective rooting depth is 20 to 40 inches. Runoff is slow or medium, and the hazard of water erosion is slight or moderate.

Rock outcrop consists of areas of exposed bedrock. Runoff is very rapid in these areas.

The McMullin soil is shallow and well drained. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Typically, the surface layer is dark reddish brown gravelly loam about 7 inches thick. The subsoil is dark reddish brown gravelly clay loam about 10 inches thick. Bedrock is at a depth of about 17 inches. The depth to bedrock ranges from 12 to 20 inches. In some areas the surface layer is stony.

Permeability is moderate in the McMullin soil. Available water capacity is about 2 inches. The effective rooting depth is 12 to 20 inches. Runoff is slow or medium, and the hazard of water erosion is slight or moderate.

This unit is used for livestock grazing and wildlife habitat. The main limitations affecting livestock grazing are compaction, erosion, the Rock outcrop, cobbles and stones on the surface, and droughtiness. The McMullin soil also is limited by the depth to bedrock. The vegetation suitable for grazing includes Idaho fescue, bluebunch wheatgrass, and pine bluegrass. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment. The use of ground equipment is not practical because of the cobbles and stones on the surface and the Rock outcrop.

This unit is poorly suited to range seeding. The main limitations are the depth to bedrock in the McMullin soil, droughtiness, the cobbles and stones on the surface, and the Rock outcrop. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the slope and the depth to bedrock.

The vegetative site in areas of the Skookum soil is Droughty Slopes, 20- to 30-inch precipitation zone, and the one in areas of the McMullin soil is Loamy Shrub Scabland, 18- to 35-inch precipitation zone.

173F—Skookum-Rock outcrop-McMullin complex, 20 to 50 percent slopes. This map unit is on hillslopes. Elevation is 2,000 to 4,700 feet. The mean annual precipitation is 20 to 35 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 150 days. The native vegetation is mainly grasses, shrubs, and forbs and a few scattered hardwoods.

This unit is about 55 percent Skookum soil, 20 percent Rock outcrop, and 15 percent McMullin soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Heppsie and Lorella soils, Carney and Medco soils on concave slopes, McNull soils on north-facing slopes, and poorly drained soils near drainageways and on concave slopes. Also included are small areas of soils that are similar to the Skookum soil but have bedrock at a depth of more than 40 inches, soils that are similar to the McMullin soil but have bedrock at a depth of less than 12 or more than 20 inches, and Skookum and McMullin soils that have slopes of less than 20 or more than 50 percent. Included areas make up about 10 percent of the total acreage.

The Skookum soil is moderately deep and well drained. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Typically, the surface layer is very dark brown very cobbly loam about 3 inches thick. The next layer is very dark grayish brown very cobbly loam about 5 inches thick. The upper 8 inches of the subsoil is very dark grayish brown very cobbly clay loam. The lower 12 inches is dark brown very cobbly and extremely cobbly clay. Bedrock is at a depth of about 28 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Permeability is slow in the Skookum soil. Available water capacity is about 2 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium or rapid, and the hazard of water erosion is moderate or high.

Rock outcrop consists of areas of exposed bedrock. Runoff is very rapid in these areas.

The McMullin soil is shallow and well drained. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Typically, the surface layer is dark reddish brown gravelly loam about 7 inches thick. The subsoil is dark reddish brown gravelly clay loam about 10 inches thick. Bedrock is at a depth of about 17 inches. The depth to bedrock ranges from 12 to 20 inches. In some areas the surface layer is stony.

Permeability is moderate in the McMullin soil. Available water capacity is about 2 inches. The effective rooting depth is 12 to 20 inches. Runoff is medium or rapid, and the hazard of water erosion is moderate or high.

This unit is used for livestock grazing and wildlife habitat. The main limitations affecting livestock grazing are the slope, erosion, compaction, the Rock outcrop, cobbles and stones on the surface, and droughtiness. The McMullin soil also is limited by the depth to bedrock. The vegetation suitable for grazing includes Idaho fescue, bluebunch wheatgrass, and pine bluegrass. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment. The use of ground equipment is not practical because of the cobbles and stones on the surface, the Rock outcrop, and the slope.

This unit is poorly suited to range seeding. The main limitations are the slope, droughtiness, the Rock outcrop, the cobbles and stones on the surface, and the depth to bedrock in the McMullin soil. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

The slope and the Rock outcrop limit access by livestock. As a result, the less sloping areas tend to be overgrazed. Constructing trails or walkways allows livestock to graze in areas where access is limited.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the slope and the depth to bedrock.

The vegetative site in areas of the Skookum soil is Droughty Slopes, 20- to 30-inch precipitation zone, and the one in areas of the McMullin soil is Loamy Shrub Scabland, 18- to 35-inch precipitation zone.

174G—Skookum-Rock outcrop-Rubble land complex, 35 to 70 percent slopes. This map unit is on hillslopes (fig. 13). Elevation is 2,800 to 4,800 feet. The mean annual precipitation is 18 to 35 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 150 days. The native vegetation is mainly grasses, shrubs, and forbs and a few scattered hardwoods.

This unit is about 40 percent Skookum soil, 20 percent Rock outcrop, and 10 percent Rubble land. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Heppsie and Lorella soils, Carney soils on concave slopes, Bogus and McNull soils on north-facing slopes, poorly drained soils near drainageways and on concave slopes, and soils that are similar to the Skookum soil but have bedrock at a depth of more than 40 inches. Also included are small areas where slopes are less than 35 or more than 70 percent. Included areas make up about 30 percent of the total acreage.

The Skookum soil is moderately deep and well drained. It formed in residuum and colluvium derived dominantly from andesite, tuff, and breccia. Typically, the surface layer is very dark brown very cobbly loam about 3 inches thick. The next layer is very dark grayish brown very cobbly loam about 5 inches thick. The upper 8 inches of the subsoil is very dark grayish brown very cobbly clay loam. The lower 12 inches is dark brown very cobbly and extremely cobbly clay. Bedrock is at a depth of about 28 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is stony.

Permeability is slow in the Skookum soil. Available water capacity is about 2 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

Rock outcrop consists of areas of exposed bedrock. Rubble land consists of areas of stones and boulders. Runoff is very rapid in areas of both the Rock outcrop and the Rubble land.

This unit is used for livestock grazing and wildlife habitat. The main limitations affecting livestock grazing are the slope, erosion, compaction, the Rock outcrop and Rubble land, cobbles and stones on the surface, and droughtiness. Because of the slope, the Rock outcrop, and the Rubble land, areas of this unit can hinder livestock movement. The vegetation suitable for grazing includes Idaho fescue, bluebunch wheatgrass, and pine bluegrass. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Grazing should be delayed until the more desirable

Figure 13.—Typical area of Skookum-Rock outcrop-Rubble land complex, 35 to 70 percent slopes.

forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment. The use of ground equipment is not practical because of the cobbles and stones on the surface, the Rock outcrop, the Rubble land, and the slope.

This unit is poorly suited to range seeding. The main limitations are the slope, droughtiness, the cobbles and stones on the surface, and the Rock outcrop and Rubble land. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

The slope and the Rock outcrop and Rubble land limit access by livestock. As a result, the less sloping areas tend to be overgrazed. Constructing trails or walkways allows livestock to graze in areas where access is limited.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the slope and the depth to bedrock.

The vegetative site is Droughty Slopes, 20- to 30-inch precipitation zone.

175F—Snowbrier gravelly loam, 25 to 50 percent north slopes. This moderately deep, well drained soil is on hillslopes. It formed in colluvium derived dominantly from schist. Elevation is 3,600 to 4,700 feet. The mean annual precipitation is 40 to 60 inches, the mean annual temperature is 40 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is very dark brown gravelly loam about 5 inches thick. The next layer is very dark grayish brown gravelly loam about 7 inches thick. The upper 10 inches of the subsoil is dark grayish brown very gravelly loam. The lower 17 inches is olive very cobbly loam. Bedrock is at a depth of about 39 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is very gravelly or stony.

Included in this unit are small areas of Acker and Norling soils and soils that are similar to the Snowbrier soil but have less than 35 percent rock fragments or have bedrock at a depth of more than 40 inches. Also included are small areas of Snowbrier soils that have slopes of less than 25 or more than 50 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderate in the Snowbrier soil. Available water capacity is about 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium or rapid, and the hazard of water erosion is high.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir and white fir. Other species that grow on this unit include incense cedar, golden chinkapin, and western hemlock. The understory vegetation includes Pacific rhododendron, cascade Oregongrape, and deerfoot vanillaleaf.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 140. The yield at culmination of the mean annual increment is 8,700 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 69,410 board feet per acre (Scribner rule) at 110 years. On the basis of a 50-year curve, the mean site index is 105.

The main limitations affecting timber production are the slope, erosion, compaction, plant competition, and seedling mortality. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

When timber is harvested, management that minimizes the risk of erosion is essential. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

Severe frost can damage or kill seedlings. A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. The large number of rock fragments in the soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings.

Increased erosion, loss of plant nutrients, and water repellency are likely to result from fires of moderate intensity.

The vegetative site is Mixed Fir-Salal (rhododendron) Forest.

176F—Snowbrier gravelly loam, 25 to 50 percent south slopes. This moderately deep, well drained soil is on hillslopes. It formed in colluvium derived dominantly from schist. Elevation is 3,600 to 4,700 feet. The mean annual precipitation is 40 to 60 inches, the mean annual temperature is 40 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is very dark brown gravelly loam about 5 inches thick. The next layer is very dark grayish brown gravelly loam about 7 inches thick. The upper 10 inches of the subsoil is dark grayish brown very gravelly loam. The lower 17 inches is olive very cobbly loam. Bedrock is at a depth of about 39 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is very gravelly or stony.

Included in this unit are small areas of Acker and Norling soils and soils that are similar to the Snowbrier soil but have less than 35 percent rock fragments or have bedrock at a depth of more than 40 inches. Also included are small areas of Snowbrier soils that have slopes of less than 25 or more than 50 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderate in the Snowbrier soil. Available water capacity is about 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium or rapid, and the hazard of water erosion is high.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir and white fir. Other species that grow on this unit include incense cedar, sugar pine, and Pacific madrone. The understory vegetation includes golden chinkapin, cascade Oregongrape, and Whipplevine.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 130. The yield at culmination of the mean annual increment is 7,740 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 58,520 board feet per acre (Scribner rule) at 110 years. On the basis of a 50-year curve, the mean site index is 95.

The main limitations affecting timber production are the slope, erosion, compaction, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

When timber is harvested, management that minimizes the risk of erosion is essential. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Severe frost can damage or kill seedlings. A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. The large number of rock fragments in the soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced by providing artificial shade for seedlings. Reforestation can be accomplished by planting Douglas fir seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

Increased erosion, loss of plant nutrients, and water repellency are likely to result from fires of moderate intensity.

The vegetative site is Douglas Fir-Madrone-Chinkapin Forest.

177C—Snowlin gravelly loam, 3 to 12 percent slopes. This very deep, well drained soil is on plateaus. It formed in colluvium derived from andesite and volcanic ash. Elevation is 4,000 to 6,000 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 40 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles and twigs about 2 inches thick. The surface layer is dark reddish brown gravelly loam about 20 inches thick. The upper 14 inches of the subsoil is dark reddish brown gravelly clay loam. The lower 26 inches is dark reddish brown very gravelly clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is stony.

Included in this unit are small areas of poorly drained soils near drainageways and on concave slopes, Rustlerpeak soils on convex slopes and on the more sloping parts of the landscape, and soils that are similar to the Snowlin soil but have bedrock within a depth of 60 inches. Also included are small areas of Snowlin soils that have slopes of less than 3 or more than 12 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderately slow in the Snowlin soil. Available water capacity is about 8 inches. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of white fir. Other species that grow on this unit include Douglas fir, incense cedar, and Rocky Mountain maple. The understory vegetation includes cascade Oregongrape, western white anemone, and gooseberry.

On the basis of a 50-year site curve, the mean site index for white fir is 80. The yield at culmination of the mean annual increment is 13,720 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years.

The main limitations affecting timber production are compaction, erosion, seedling mortality, and plant competition. Conventional methods of harvesting timber generally are suitable, but the soil may be compacted if it is moist when heavy equipment is used. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Erosion can be controlled by carefully planning the construction and maintenance of logging roads, skid trails, and landings. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Severe frost can damage or kill seedlings. Air drainage is restricted on this unit. Proper timber harvesting methods can reduce the effect of frost on regeneration. Reforestation can be accomplished by planting seedlings of frost-tolerant species, such as ponderosa pine and lodgepole pine.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

The main limitation affecting livestock grazing is compaction. The native vegetation suitable for grazing includes Canada bluegrass, Alaska oniongrass, and mountain brome. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion. The seedling survival rate may be limited, however, because of cold temperatures in spring.

The vegetative site is White Fir Forest.

178E—Snowlin gravelly loam, 12 to 35 percent north slopes. This very deep, well drained soil is on hillslopes. It formed in colluvium derived from andesite and volcanic ash. Elevation is 4,000 to 6,000 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 40 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles and twigs about 2 inches thick. The surface layer is dark reddish brown gravelly loam about 20 inches thick. The upper 14 inches of the subsoil is dark reddish brown gravelly clay loam. The lower 26 inches is dark reddish brown very gravelly clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is stony.

Included in this unit are small areas of poorly drained soils near drainageways and on concave slopes, Rustlerpeak soils on convex slopes and on the more sloping parts of the landscape, and soils that are similar to the Snowlin soil but have bedrock within a depth of 60 inches. Also included are small areas of Snowlin soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderately slow in the Snowlin soil. Available water capacity is about 8 inches. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of white fir. Other species that grow on this unit include Douglas fir, incense cedar, and Rocky Mountain maple. The understory vegetation includes cascade Oregongrape, western white anemone, and gooseberry.

On the basis of a 50-year site curve, the mean site index for white fir is 80. The yield at culmination of the mean annual increment is 13,720 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years.

The main limitations affecting timber production are erosion, compaction, plant competition, and seedling mortality. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting ponderosa pine and Douglas fir seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

Severe frost can damage or kill seedlings. In the less sloping areas where air drainage may be restricted, proper timber harvesting methods can reduce the effect of frost on regeneration.

The main limitations affecting livestock grazing are compaction and erosion. The native vegetation suitable for grazing includes Canada bluegrass, Alaska oniongrass, and mountain brome. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion. The seedling survival rate may be limited, however, because of cold temperatures in spring.

The vegetative site is White Fir Forest.

179F—Speaker-Josephine complex, 35 to 55 percent south slopes. This map unit is on hillslopes. Elevation is 1,200 to 4,000 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 45 percent Speaker soil and 40 percent Josephine soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Dubakella, Goolaway, Pearsoll, and Siskiyou soils; Pollard, Beekman, and McMullin soils on the less sloping parts of the landscape and on concave slopes; poorly drained soils near drainageways and on concave slopes; and soils that are similar to the Speaker and Josephine soils but have more than 35 percent rock fragments. Also included are small areas of Speaker and Josephine soils that have slopes of less than 35 or more than 55 percent. Included areas make up about 15 percent of the total acreage.

The Speaker soil is moderately deep and well drained. It formed in colluvium derived dominantly from metamorphic rock. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is dark brown loam about 13 inches thick. The upper 10 inches of the subsoil also is dark brown loam. The lower 12 inches is brown gravelly clay loam. Weathered bedrock is at a depth of about 35 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is gravelly loam.

Permeability is moderately slow in the Speaker soil. Available water capacity is about 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

The Josephine soil is deep and well drained. It formed in colluvium and residuum derived dominantly from metamorphic rock. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is dark reddish brown gravelly loam about 15 inches thick. The subsoil is dark reddish brown and reddish brown gravelly clay loam about 40 inches thick. Weathered bedrock is at a depth of about 55 inches. The depth to bedrock ranges from 40 to 60 inches. In some areas the surface layer is clay loam.

Permeability is moderately slow in the Josephine soil. Available water capacity is about 7 inches. The effective rooting depth is 40 to 60 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include sugar pine and California black oak. The understory vegetation includes canyon live oak, deerbrush, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 115 on the Speaker soil. The yield at culmination of the mean annual increment is 6,360 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 50,700 board feet per acre (Scribner rule) at 130 years. On the basis of a 50-year curve, the mean site index is 85.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 105 on the Speaker soil. The yield at culmination of the mean annual increment is 4,480 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 50,040 board feet per acre (Scribner rule) at 120 years.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 120 on the Josephine soil. The yield at culmination of the mean annual increment is 6,900 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 52,440 board feet per acre (Scribner rule) at 120 years. On the basis of a 50-year curve, the mean site index is 90.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 115 on the Josephine soil. The yield at culmination of the mean annual increment is 5,280 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 56,780 board feet per acre (Scribner rule) at 110 years.

The main limitations affecting timber production are the slope, erosion, compaction, seedling mortality, and plant competition. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. Using standard wheeled and tracked equipment when the soils are moist causes rutting and compaction. Puddling can occur when the soils are wet. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soils are saturated.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced by providing artificial shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

The vegetative site is Douglas Fir-Black Oak Forest.

180G—Steinmetz sandy loam, 35 to 75 percent north slopes. This very deep, somewhat excessively drained soil is on hillslopes. It formed in colluvium derived from granitic rock. Elevation is 2,000 to 4,000 feet. The mean annual precipitation is 45 to 60 inches, the mean annual temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles and twigs about 1 inch thick. The surface layer is very dark grayish brown and brown sandy loam about 13 inches thick. The subsoil to a depth of 60 inches is dark yellowish brown and brown sandy loam. The depth to bedrock is 60 inches or more.

Included in this unit are small areas of Dubakella, Goolaway, Gravecreek, Musty, and Rogue soils; Rock outcrop; Atring and Kanid soils on the more sloping parts of the landscape; Lettia soils on the less sloping parts of the landscape and on concave slopes; and soils that are similar to the Steinmetz soil but that have bedrock within a depth of 60 inches. Also included are small areas of Steinmetz soils that have slopes of less than 35 or more than 75 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately rapid in the Steinmetz soil. Available water capacity is about 6 inches. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir. Other species that grow on this unit include incense cedar, western hemlock, and Pacific madrone. The understory vegetation includes golden chinkapin, salal, and cascade Oregongrape.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 140. The yield at culmination of the mean annual increment is 8,700 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 69,410 board feet per acre (Scribner rule) at 110 years. On the basis of a 50-year curve, the mean site index is 110.

The main limitations affecting timber production are the slope, erosion, compaction, plant competition, and seedling mortality. When timber is harvested, management that minimizes the risk of erosion is essential. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

This unit is subject to slumping, especially in areas adjacent to drainageways. Road failure and landslides are likely to occur after road construction and clearcutting.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Building the roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings.

Increased erosion, loss of plant nutrients, and water repellency are likely to result from fires of moderate intensity.

The vegetative site is Mixed Fir-Salal (rhododendron) Forest.

181G—Steinmetz sandy loam, 35 to 75 percent south slopes. This very deep, somewhat excessively drained soil is on hillslopes. It formed in colluvium derived from granitic rock. Elevation is 2,000 to 4,000 feet. The mean annual precipitation is 45 to 60 inches, the mean annual temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles and twigs about 1 inch thick. The surface layer is very dark grayish brown and brown sandy loam about 13 inches thick. The subsoil to a depth of 60 inches is dark yellowish brown and brown sandy loam. The depth to bedrock is 60 inches or more.

Included in this unit are small areas of Dubakella, Goolaway, Gravecreek, Musty, and Rogue soils; Rock outcrop; Atring and Kanid soils on the more sloping parts of the landscape; Lettia soils on the less sloping parts of the landscape and on concave slopes; and soils that are similar to the Steinmetz soil but have bedrock within a depth of 60 inches. Also included are small areas of Steinmetz soils that have slopes of less than 35 or more than 75 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately rapid in the Steinmetz soil. Available water capacity is about 6 inches. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir. Other species that grow on this unit include incense cedar, sugar pine, and Pacific madrone. The understory vegetation includes golden chinkapin, Whipplevine, and cascade Oregongrape.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 130. The yield at culmination of the mean annual increment is 7,740 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 58,520 board feet per acre (Scribner rule) at 110 years. On the basis of a 50-year curve, the mean site index is 100.

The main limitations affecting timber production are the slope, erosion, compaction, seedling mortality, and plant competition. When timber is harvested, management that minimizes the risk of erosion is essential. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

This unit is subject to slumping, especially in areas adjacent to drainageways. Road failure and landslides are likely to occur after road construction and clearcutting.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Building the roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced by providing artificial shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

Increased erosion, loss of plant nutrients, and water repellency are likely to result from fires of moderate intensity.

The vegetative site is Douglas Fir-Madrone-Chinkapin Forest.

182E—Straight extremely gravelly loam, 12 to 35 percent north slopes. This moderately deep, well drained soil is on hillslopes. It formed in colluvium derived from andesite, tuff, and breccia. Elevation is 2,000 to 4,000 feet. The mean annual precipitation is 35 to 55 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about 1½ inches thick. The surface layer is dark reddish brown extremely gravelly loam about 9 inches thick. The next layer is dark brown very gravelly loam about 10 inches thick. The upper 11 inches of the subsoil also is dark brown very gravelly loam. The lower 5 inches is dark brown very cobbly clay loam. Weathered bedrock is at a depth of about 35 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is gravelly or stony.

Included in this unit are small areas of Freezener and Geppert soils, Rock outcrop and Shippa soils on ridges and convex slopes, poorly drained soils near drainageways and on concave slopes, and soils that are similar to the Straight soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Straight soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderate in the Straight soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir. Other species that grow on this unit include white fir, incense cedar, and Pacific dogwood. The understory vegetation includes Pacific serviceberry, cascade Oregongrape, and deerfoot vanillaleaf.

On the basis of a 100 year site curve, the mean site index for Douglas fir is 115. The yield at culmination of the mean annual increment is 6,360 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 50,700 board feet per acre (Scribner rule) at 130 years. On the basis of a 50-year curve, the mean site index is 85.

The main limitations affecting timber production are erosion, compaction, plant competition, and seedling mortality. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. The large number of rock fragments in the soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings.

The main limitations affecting livestock grazing are compaction and erosion. The native vegetation suitable for grazing includes western fescue, mountain brome, tall trisetum, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Dogwood Forest.

183E—Straight extremely gravelly loam, 12 to 35 percent south slopes. This moderately deep, well drained soil is on hillslopes. It formed in colluvium derived from andesite, tuff, and breccia. Elevation is 2,000 to 4,000 feet. The mean annual precipitation is 35 to 55 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about 1½ inches thick. The surface layer is dark reddish brown extremely gravelly loam about 9 inches thick. The next layer is dark brown very gravelly loam about 10 inches thick. The upper 11 inches of the subsoil also is dark brown very gravelly loam. The lower 5 inches is dark brown very cobbly clay loam. Weathered bedrock is at a depth of about 35 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is gravelly or stony.

Included in this unit are small areas of Freezener and Geppert soils, Rock outcrop and Shippa soils on ridges and convex slopes, poorly drained soils near drainageways and on concave slopes, and soils that are similar to the Straight soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Straight soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderate in the Straight soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir. Other species that grow on this unit include sugar pine, ponderosa pine, white fir, and California black oak. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 110. The yield at culmination of the mean annual increment is 5,880 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 48,300 board feet per acre (Scribner rule) at 140 years. On the basis of a 50-year curve, the mean site index is 75.

The main limitations affecting timber production are erosion, compaction, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. The large number of rock fragments in the soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

The main limitations affecting livestock grazing are compaction and erosion. The native vegetation suitable for grazing includes western fescue, mountain brome, tall trisetum, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Mixed Pine Forest.

184G—Straight-Shippa extremely gravelly loams, 35 to 70 percent north slopes. This map unit is on hillslopes. Elevation is 2,000 to 4,000 feet. The mean annual precipitation is 35 to 55 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 60 percent Straight soil and 20 percent Shippa soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Freezener and Geppert soils and Rock outcrop on ridges and convex slopes, soils that are similar to the Straight soil but have bedrock at a depth of more than 40 inches, and soils that are similar to the Shippa soil but have bedrock within a depth of 10 inches. Also included are small areas of Straight and Shippa soils that have slopes of less than 35 or more than 70 percent. Included areas make up about 20 percent of the total acreage.

The Straight soil is moderately deep and well drained. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1½ inches thick. The surface layer is dark reddish brown extremely gravelly loam about 9 inches thick. The next layer is dark brown very gravelly loam about 10 inches thick. The upper 11 inches of the subsoil also is dark brown very gravelly loam. The lower 5 inches is dark brown very cobbly clay loam. Weathered bedrock is at a depth of about 35 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is gravelly or stony.

Permeability is moderate in the Straight soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

The Shippa soil is shallow and well drained. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Typically, the surface layer is dark brown extremely gravelly loam about 4 inches thick. The subsoil is brown extremely cobbly loam about 12 inches thick. Bedrock is at a depth of about 16 inches. The depth to bedrock ranges from 12 to 20 inches. In some areas the surface layer is stony.

Permeability is moderately rapid in the Shippa soil. Available water capacity is about 1 inch. The effective rooting depth is 12 to 20 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir. Other species that grow on this unit include white fir, incense cedar, and Pacific dogwood. The understory vegetation includes Pacific serviceberry, cascade Oregongrape, and deerfoot vanillaleaf.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 115 on the Straight soil. The yield at culmination of the mean annual increment is 6,360 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 50,700 board feet per acre (Scribner rule) at 130 years. On the basis of a 50-year curve, the mean site index is 85.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 85 on the Shippa soil. The yield at culmination of the mean annual increment is 4,480 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years and 27,520 board feet per acre (Scribner rule) at 160 years. On the basis of a 50-year curve, the mean site index is 60.

The main limitations affecting timber production are the slope, erosion, compaction, plant competition, and seedling mortality. Also, the bedrock underlying the Shippa soil restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. If the soils are excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soils are moist causes rutting and compaction. Puddling can occur when the soils are wet. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. In areas of the Shippa soil, however, road cutbanks may not respond well to seeding and mulching because of the large amount of fractured bedrock that is exposed. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soils are saturated.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Building the roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. The large number of rock fragments in both soils and the limited depth of the Shippa soil also increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings.

The main limitations affecting livestock grazing are erosion, compaction, and the slope. The native vegetation suitable for grazing includes western fescue, mountain brome, tall trisetum, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soils. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Dogwood Forest.

185G—Straight-Shippa extremely gravelly loams, 35 to 60 percent south slopes. This map unit is on hillslopes. Elevation is 2,000 to 4,000 feet. The mean annual precipitation is 35 to 55 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 55 percent Straight soil and 25 percent Shippa soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Freezener and Geppert soils, Rock outcrop on ridges and convex slopes, soils that are similar to the Straight soil but have bedrock at a depth of more than 40 inches, and soils that are similar to the Shippa soil but have bedrock within a depth of 10 inches. Also included are small areas of Straight and Shippa soils that have slopes of less than 35 or more than 60 percent. Included areas make up about 20 percent of the total acreage.

The Straight soil is moderately deep and well drained. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Typically, the surface is covered with a layer of needles, leaves, and twigs about 1½ inches thick. The surface layer is dark reddish brown extremely gravelly loam about 9 inches thick. The next layer is dark brown very gravelly loam about 10 inches thick. The upper 11 inches of the subsoil also is dark brown very gravelly loam. The lower 5 inches is dark brown very cobbly clay loam. Weathered bedrock is at a depth of about 35 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is gravelly or stony.

Permeability is moderate in the Straight soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

The Shippa soil is shallow and well drained. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Typically, the surface layer is dark brown extremely gravelly loam about 4 inches thick. The subsoil is brown extremely cobbly loam about 12 inches thick. Bedrock is at a depth of about 16 inches. The depth to bedrock ranges from 12 to 20 inches. In some areas the surface layer is stony.

Permeability is moderately rapid in the Shippa soil. Available water capacity is about 1 inch. The effective rooting depth is 12 to 20 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir. Other species that grow on this unit include sugar pine, ponderosa pine, white fir, and California black oak. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 110 on the Straight soil. The yield at culmination of the mean annual increment is 5,880 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 48,300 board feet per acre (Scribner rule) at 140 years. On the basis of a 50-year curve, the mean site index is 75.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 85 on the Shippa soil. The yield at culmination of the mean annual increment is 4,480 cubic feet per acre in a fully stocked, even-aged stand of trees at 70 years and 27,520 board feet per acre (Scribner rule) at 160 years. On the basis of a 50-year curve, the mean site index is 60.

The main limitations affecting timber production are the slope, erosion, compaction, seedling mortality, and plant competition. Also, the bedrock underlying the Shippa soil restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. If the soils are excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soils are moist causes rutting and compaction. Puddling can occur when the soils are wet. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. In areas of the Shippa soil, however, road cutbanks may not respond well to seeding and mulching because of the large amount of fractured bedrock that is exposed. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soils are saturated.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Building the roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. The large number of rock fragments in both soils and the limited depth of the Shippa soil also increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced by providing artificial shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

The main limitations affecting livestock grazing are erosion, compaction, and the slope. The native vegetation suitable for grazing includes western fescue, mountain brome, tall trisetum, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soils. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Mixed Pine Forest.

186H—Tablerock-Rock outcrop complex, 35 to 110 percent slopes. This map unit is on hillslopes. Elevation is 1,250 to 3,600 feet. The mean annual precipitation is 18 to 30 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 120 to 180 days. The native vegetation is mainly hardwoods and conifers and an understory of grasses, shrubs, and forbs.

This unit is about 45 percent Tablerock soil and 35 percent Rock outcrop. The Tablerock soil has slopes of 35 to 50 percent, and Rock outcrop has slopes of more than 50 percent. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Carney, Darow, and Heppsie soils; soils that are similar to Carney soils but have bedrock at a depth of less than 20 or more than 40 inches; and Brader and Debenger soils and on ridges and convex slopes. Also included are small areas of soils that are similar to the Tablerock soil but have bedrock within a depth of 60 inches. Included areas make up about 20 percent of the total acreage.

The Tablerock soil is very deep and moderately well drained. It formed in colluvium derived dominantly from andesite and sandstone. Typically, the surface is covered with a layer of leaves and twigs about 1½ inches thick. The surface layer is very dark brown gravelly loam about 3 inches thick. The next layer is very dark grayish brown very cobbly clay loam about 7 inches thick. The upper 10 inches of the subsoil is dark brown very cobbly clay loam. The next 18 inches is brown very cobbly clay. The lower 27 inches is dark yellowish brown gravelly clay loam and gravelly loam. Weathered bedrock is at a depth of about 65 inches. The depth to bedrock is 60 inches or more. In some areas the surface layer is cobbly or stony.

Permeability is very slow in the Tablerock soil. Available water capacity is about 7 inches. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high. The water table fluctuates between depths of 4 and 6 feet from December through April.

Rock outcrop consists of areas of exposed bedrock. Runoff is very rapid in these areas.

This unit is used for recreational development and livestock grazing.

The main limitations affecting recreational development are the slope, the Rock outcrop, and the high content of clay, which makes the soil sticky and plastic when wet and thus restricts trafficability. These limitations restrict the use of this unit mainly to paths and trails, which should extend across the slope. The steep slopes and the Rock outcrop should be avoided unless they are to be highlighted in the development.

The main limitations affecting livestock grazing are erosion, compaction, the slope, droughtiness, and the Rock outcrop. The vegetation suitable for grazing includes Idaho fescue, prairie junegrass, and western fescue. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

This unit is poorly suited to range seeding. The main limitations are the slope, droughtiness, and the Rock outcrop. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

The steeper slopes and the Rock outcrop limit access by livestock. As a result, the less sloping areas tend to be overgrazed. Constructing trails or walkways allows livestock to graze in areas where access is limited.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment. The use of ground equipment is not practical because of the Rock outcrop and the slope.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the slope and the Rock outcrop.

The vegetative site is Pine-Douglas Fir-Fescue.

187A—Takilma cobbly loam, 0 to 3 percent slopes. This very deep, well drained soil is on stream terraces. It formed in alluvium derived from mixed sources. Elevation is 1,000 to 2,500 feet. The mean annual precipitation is 20 to 35 inches, the mean annual temperature is 50 to 54 degrees F, and the average frost-free period is 140 to 180 days. The native vegetation is mainly hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface layer is very dark grayish brown cobbly loam about 6 inches thick. The upper 9 inches of the subsoil is very dark grayish brown very cobbly loam. The lower 9 inches is brown extremely cobbly sandy loam. The substratum to a depth of 60 inches is dark yellowish brown and brown extremely gravelly and very gravelly sandy loam.

Included in this unit are small areas of Evans, Newberg, and Camas soils on flood plains; Medford soils on the lower terraces; poorly drained soils near drainageways; Central Point and Foehlin soils; and soils that are similar to the Takilma soil but have a substratum of very gravelly sand. Also included are small areas of Takilma soils that have slopes of more than 3 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderately rapid in the Takilma soil. Available water capacity is about 4 inches. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

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

This unit is suited to hay and pasture. The main limitations are droughtiness and cobbles on the surface. The cobbles limit the use of equipment in some areas. In summer, irrigation is needed for the maximum production of most forage crops. Sprinkler irrigation is the best method of applying water. Border and contour flood irrigation systems also are suitable. For the efficient application and removal of surface irrigation water, land leveling is needed. To prevent overirrigation and the leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. Because the soil is droughty, the applications should be light and frequent. The use of pipe, ditch lining, or drop structures in irrigation ditches reduces water loss and the hazard of erosion.

Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

The main limitations affecting homesite development are the moderately rapid permeability and the large number of rock fragments on and below the surface.

The suitability of this unit for septic tank absorption fields is limited because the extremely gravelly substratum has a poor filtering capacity. Alternative waste disposal systems may function properly on this unit. Suitable included soils are throughout the unit. Onsite investigation is needed to locate such soils.

Establishing plants is difficult in areas where the surface layer has been removed. Mulching and applying fertilizer help to establish plants in cut areas. Gravel and cobbles should be removed from disturbed areas, particularly areas used for lawns. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. In many areas it may be necessary to haul in topsoil for lawns and gardens. Because of droughtiness and a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

The main limitations affecting livestock grazing are compaction, the cobbly surface layer, and droughtiness. The vegetation suitable for grazing includes Idaho fescue, tall trisetum, and western fescue. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Grazing should be delayed until the soil is firm and the more desirable forage plants have achieved enough growth to withstand grazing pressure.

Range seeding is suitable if the site is in poor condition. The main limitations are the cobbly surface layer and droughtiness. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment. In places the use of ground equipment is limited by the cobbles on the surface.

This unit is limited as a site for livestock watering ponds and other water impoundments because of seepage.

The vegetative site is Pine-Douglas Fir-Fescue.

188E—Tallowbox gravelly sandy loam, 20 to 35 percent north slopes. This moderately deep, somewhat excessively drained soil is on hillslopes and ridges. It formed in colluvium derived from granitic rock. Elevation is 1,000 to 4,000 feet. The mean annual precipitation is 25 to 40 inches, the mean annual temperature is 46 to 54 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is dark brown gravelly sandy loam about 6 inches thick. The upper 6 inches of the subsoil is dark brown sandy loam. The lower 11 inches is brown gravelly sandy loam. Weathered bedrock is at a depth of about 23 inches. The depth to bedrock ranges from 20 to 40 inches.

Included in the unit are small areas of Offenbacher, Shefflein, and Vannoy soils; Caris and Voorhies soils on the more sloping parts of the landscape; Ruch soils on toe slopes; poorly drained soils near drainageways and on concave slopes; and soils that are similar to the Tallowbox soil but have bedrock at a depth of less than 20 or more than 40 inches. Also included are small areas of Tallowbox soils that have slopes of less than 20 or more than 35 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderately rapid in the Tallowbox soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is high.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include incense cedar, sugar pine, and Pacific madrone. The understory vegetation includes creambush oceanspray, common snowberry, and tall Oregon grape.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 100. The yield at culmination of the mean annual increment is 5,040 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 39,750 board feet per acre (Scribner rule) at 150 years. On the basis of a 50-year curve, the mean site index is 70.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 100. The yield at culmination of the mean annual increment is 4,080 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 44,640 board feet per acre (Scribner rule) at 120 years.

The main limitations affecting timber production are erosion, compaction, plant competition, and seedling mortality. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

When timber is harvested, management that minimizes the risk of erosion is essential. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

This unit is subject to slumping, especially in areas adjacent to drainageways. Road failure and landslides are likely to occur after road construction and clearcutting. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings.

Increased erosion, loss of plant nutrients, and water repellency are likely to result from fires of moderate intensity.

The vegetative site is Douglas Fir Forest.

188G—Tallowbox gravelly sandy loam, 35 to 70 percent north slopes. This moderately deep, somewhat excessively drained soil is on hillslopes. It formed in colluvium derived from granitic rock. Elevation is 1,000 to 4,000 feet. The mean annual precipitation is 25 to 40 inches, the mean annual temperature is 46 to 54 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is dark brown gravelly sandy loam about 6 inches thick. The upper 6 inches of the subsoil is dark brown sandy loam. The lower 11 inches is brown gravelly sandy loam. Weathered bedrock is at a depth of about 23 inches. The depth to bedrock ranges from 20 to 40 inches.

Included in this unit are small areas of Caris, Offenbacher, Vannoy, and Voorhies soils; soils that are similar to the Tallowbox soil but have bedrock at a depth of less than 20 or more than 40 inches; and Tallowbox soils that have slopes of less than 35 or more than 70 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderately rapid in the Tallowbox soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include incense cedar, sugar pine, and Pacific madrone. The understory vegetation includes creambush oceanspray, common snowberry, and tall Oregon grape.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 100. The yield at culmination of the mean annual increment is 5,040 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 39,750 board feet per acre (Scribner rule) at 150 years. On the basis of a 50-year curve, the mean site index is 70.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 100. The yield at culmination of the mean annual increment is 4,080 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 44,640 board feet per acre (Scribner rule) at 120 years.

The main limitations affecting timber production are the slope, erosion, compaction, plant competition, and seedling mortality. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

When timber is harvested, management that minimizes the risk of erosion is essential. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

This unit is subject to slumping, especially in areas adjacent to drainageways. Road failure and landslides are likely to occur after road construction and clearcutting.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Building the roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings.

Increased erosion, loss of plant nutrients, and water repellency are likely to result from fires of moderate intensity.

The vegetative site is Douglas Fir Forest.

189E—Tallowbox gravelly sandy loam, 20 to 35 percent south slopes. This moderately deep, somewhat excessively drained soil is on hillslopes and ridges. It formed in colluvium derived from granitic rock. Elevation is 1,000 to 4,000 feet. The mean annual precipitation is 25 to 40 inches, the mean annual temperature is 46 to 54 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is dark brown gravelly sandy loam about 6 inches thick. The upper 6 inches of the subsoil is dark brown sandy loam. The lower 11 inches is brown gravelly sandy loam. Weathered bedrock is at a depth of about 23 inches. The depth to bedrock ranges from 20 to 40 inches.

Included in the unit are small areas Offenbacher and Vannoy soils, soils that are similar to the Tallowbox soil but have bedrock at a depth of less than 20 or more than 40 inches, Caris and Voorhies soils on the more sloping parts of the landscape, Ruch soils on toe slopes, and poorly drained soils near drainageways and on concave slopes. Also included are small areas of Tallowbox soils that have slopes of less than 20 or more than 35 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderately rapid in the Tallowbox soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is high.

This unit is used for timber production and wildlife habitat. It is suited to the production of ponderosa pine and Douglas fir. Other species that grow on this unit include incense cedar, sugar pine, and Pacific madrone. The understory vegetation includes deerbrush, tall Oregon grape, and Idaho fescue.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 90. The yield at culmination of the mean annual increment is 3,400 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 37,960 board feet per acre (Scribner rule) at 130 years.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 90. The yield at culmination of the mean annual increment is 4,200 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 31,840 board feet per acre (Scribner rule) at 160 years. On the basis of a 50-year curve, the mean site index is 60.

The main limitations affecting timber production are erosion, compaction, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

When timber is harvested, management that minimizes the risk of erosion is essential. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

This unit is subject to slumping, especially in areas adjacent to drainageways. Road failure and landslides are likely to occur after road construction and clearcutting. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced by providing artificial shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial

reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

Increased erosion, loss of plant nutrients, and water repellency are likely to result from fires of moderate intensity.

The vegetative site is Mixed Pine-Douglas Fir-Fescue Forest, Granitic.

189G—Tallowbox gravelly sandy loam, 35 to 60 percent south slopes. This moderately deep, somewhat excessively drained soil is on hillslopes. It formed in colluvium derived from granitic rock. Elevation is 1,000 to 4,000 feet. The mean annual precipitation is 25 to 40 inches, the mean annual temperature is 46 to 54 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is dark brown gravelly sandy loam about 6 inches thick. The upper 6 inches of the subsoil is dark brown sandy loam. The lower 11 inches is brown gravelly sandy loam. Weathered bedrock is at a depth of about 23 inches. The depth to bedrock ranges from 20 to 40 inches.

Included in this unit are small areas of Caris, Offenbacher, Vannoy, and Voorhies soils on concave slopes or on the less sloping parts of the landscape; soils that are similar to the Tallowbox soil but have bedrock at a depth of less than 20 or more than 40 inches; and Tallowbox soils that have slopes of less than 35 or more than 70 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderately rapid in the Tallowbox soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production and wildlife habitat. It is suited to the production of ponderosa pine and Douglas fir. Other species that grow on this unit include incense cedar, sugar pine, and Pacific madrone. The understory vegetation includes deerbrush, tall Oregon grape, and Idaho fescue.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 90. The yield at culmination of the mean annual increment is 3,400 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 37,960 board feet per acre (Scribner rule) at 130 years.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 90. The yield at culmination of the mean annual increment is 4,200 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 31,840 board feet per acre (Scribner rule) at 160 years. On the basis of a 50-year curve, the mean site index is 60.

The main limitations affecting timber production are the slope, erosion, compaction, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

When timber is harvested, management that minimizes the risk of erosion is essential. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

This unit is subject to slumping, especially in areas adjacent to drainageways. Road failure and landslides are likely to occur after road construction and clearcutting.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Building the roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced by providing artificial shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

Increased erosion, loss of plant nutrients, and water repellency are likely to result from fires of moderate intensity.

The vegetative site is Mixed Pine-Douglas Fir-Fescue Forest, Granitic.

190E—Tatouche gravelly loam, 12 to 35 percent north slopes. This very deep, well drained soil is on hillslopes. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Elevation is 3,600 to 5,500 feet. The mean annual precipitation is 30 to 50 inches, the mean annual temperature is 40 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles and twigs about 2 inches thick. The surface layer is very dark brown gravelly loam about 11 inches thick. The upper 8 inches of the subsoil is dark brown gravelly clay loam. The lower 41 inches is dark brown clay. The substratum to a depth of 73 inches is strong brown clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is stony or cobbly.

Included in this unit are small areas of Pinehurst soils; Bybee, Kanutchan, and Sibannac soils near drainageways and on concave slopes; Farva soils on convex slopes; and soils that are similar to the Tatouche soil but have bedrock within a depth of 60 inches. Also included are small areas of Tatouche soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately slow in the Tatouche soil. Available water capacity is about 8 inches. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and white fir. Other species that grow on this unit include incense cedar and ponderosa pine. The understory vegetation includes creambush oceanspray, cascade Oregongrape, and whitevein shinleaf.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 125. The yield at culmination of the mean annual increment is 7,320 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 58,200 board feet per acre (Scribner rule) at 120 years. On the basis of a 50-year curve, the mean site index is 90.

The main limitations affecting timber production are erosion, compaction, plant competition, and seedling mortality. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting ponderosa pine and Douglas fir seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

Severe frost can damage or kill seedlings. In the less sloping areas where air drainage may be restricted, proper timber harvesting methods can reduce the effect of frost on regeneration.

The main limitations affecting livestock grazing are compaction and erosion. The native vegetation suitable for grazing includes western fescue, mountain brome, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Oceanspray Forest.

190G—Tatouche gravelly loam, 35 to 65 percent north slopes. This very deep, well drained soil is on hillslopes. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Elevation is 3,600 to 5,500 feet. The mean annual precipitation is 30 to 50 inches, the mean annual temperature is 40 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles and twigs about 2 inches thick. The surface layer is very dark brown gravelly loam about 11 inches thick. The upper 8 inches of the subsoil is dark brown gravelly clay loam. The lower 41 inches is dark brown clay. The substratum to a depth of 73 inches is strong brown clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is stony or cobbly.

Included in this unit are small areas of Bybee and Pinehurst soils on concave slopes and on the less sloping parts of the landscape, Woodseye and Farva soils and Rock outcrop on ridges and convex slopes, and soils that are similar to the Tatouche soil but have bedrock within a depth of 60 inches. Also included are small areas of Tatouche soils that have slopes of less than 35 or more than 65 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately slow in the Tatouche soil. Available water capacity is about 8 inches. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and white fir. Other species that grow on this unit include incense cedar and ponderosa pine. The understory vegetation includes creambush oceanspray, cascade Oregongrape, and whitevein shinleaf.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 120. The yield at culmination of the mean annual increment is 6,900 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 52,440 board feet per acre (Scribner rule) at 120 years. On the basis of a 50-year curve, the mean site index is 90.

The main limitations affecting timber production are the slope, erosion, compaction, plant competition, and seedling mortality. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Building the roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting ponderosa pine and Douglas fir seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

Severe frost can damage or kill seedlings. Proper timber harvesting methods can reduce the effect of frost on regeneration.

The main limitations affecting livestock grazing are erosion, compaction, and the slope. The native vegetation suitable for grazing includes western fescue, mountain brome, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the soil is firm and the more desirable forage plants have achieved enough growth to withstand grazing pressure.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Oceanspray Forest.

191E—Tatouche gravelly loam, 12 to 35 percent south slopes. This very deep, well drained soil is on hillslopes. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Elevation is 3,600 to 5,500 feet. The mean annual precipitation is 30 to 50 inches, the mean annual temperature is 40 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles and twigs about 2 inches thick. The surface layer is very dark brown gravelly loam about 11 inches thick. The upper 8 inches of the subsoil is dark brown gravelly clay loam. The lower 41 inches is dark brown clay. The substratum to a depth of 73 inches is strong brown clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is stony or cobbly.

Included in this unit are small areas of Pinehurst soils; Bybee, Kanutchan, and Sibannac soils near drainageways and on concave slopes; Farva soils and Rock outcrop on ridges and convex slopes; and soils that are similar to the Tatouche soil but have bedrock within a depth of 60 inches. Also included are small areas of Tatouche soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately slow in the Tatouche soil. Available water capacity is about 6.5 to 11 inches. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and white fir. Other species that grow on this unit include incense cedar and ponderosa pine. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and common snowberry.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 110. The yield at culmination of the mean annual increment is 5,880 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 48,300 board feet per acre (Scribner rule) at 140 years. On the basis of a 50-year curve, the mean site index is 85.

The main limitations affecting timber production are erosion, compaction, seedling mortality, and plant competition. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Severe frost can damage or kill seedlings. In the less sloping areas where air drainage may be restricted, proper timber harvesting methods can reduce the effect of frost on regeneration.

Undesirable plants limit natural or artificial

reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

The main limitations affecting livestock grazing are compaction and erosion. The native vegetation suitable for grazing includes western fescue, mountain brome, tall trisetum, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Serviceberry Forest.

191G—Tatouche gravelly loam, 35 to 60 percent south slopes. This very deep, well drained soil is on hillslopes. It formed in colluvium derived dominantly from andesite, tuff, and breccia. Elevation is 3,600 to 5,500 feet. The mean annual precipitation is 30 to 50 inches, the mean annual temperature is 40 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles and twigs about 2 inches thick. The surface layer is very dark brown gravelly loam about 11 inches thick. The upper 8 inches of the subsoil is dark brown gravelly clay loam. The lower 41 inches is dark brown clay. The substratum to a depth of 73 inches is strong brown clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is stony or cobbly.

Included in this unit are small areas of Bybee and Pinehurst soils on concave slopes and on the less sloping parts of the landscape, Woodseye and Farva soils and Rock outcrop on ridges and convex slopes, and soils that are similar to the Tatouche soil but have bedrock within a depth of 60 inches. Also included are small areas of Tatouche soils that have slopes of less than 35 or more than 60 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately slow in the Tatouche soil. Available water capacity is about 8 inches. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and white fir. Other species that grow on this unit include incense cedar and ponderosa pine. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and common snowberry.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 105. The yield at culmination of the mean annual increment is 5,460 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 45,600 board feet per acre (Scribner rule) at 150 years. On the basis of a 50-year curve, the mean site index is 80.

The main limitations affecting timber production are the slope, erosion, compaction, seedling mortality, and plant competition. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Building the roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced by providing artificial shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Severe frost can damage or kill seedlings. Proper timber harvesting methods can reduce the effect of frost on regeneration.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

The main limitations affecting livestock grazing are erosion, compaction, and the slope. The native vegetation suitable for grazing includes western fescue, mountain brome, tall trisetum, and Alaska oniongrass. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Fir-Serviceberry Forest.

192A—Terrabella clay loam, 0 to 3 percent slopes. This very deep, poorly drained soil is in basins. It formed in alluvium derived dominantly from andesite, tuff, and breccia. Elevation is 1,500 to 3,500 feet. The mean annual precipitation is 25 to 45 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 150 days. The native vegetation is mainly grasses, sedges, and forbs.

Typically, the surface layer is very dark brown clay loam about 10 inches thick. The upper 18 inches of the subsoil is dark reddish brown and dark reddish gray clay. The lower 22 inches is dark brown clay. The substratum is dark yellowish brown gravelly clay loam about 10 inches thick. The depth to bedrock is 60 inches or more. In some areas the surface layer is gravelly or cobbly.

Included in this unit are small areas of Coker, Freezener, and Geppert soils; very poorly drained, organic soils; and soils that are similar to the Terrabella soil but have bedrock within a depth of 60 inches. Also included are small areas of Terrabella soils that have slopes of more than 3 percent. Included areas make up about 15 percent of the total acreage.

Permeability is slow in the Terrabella soil. Available water capacity is about 11 inches. The effective rooting depth is limited by the water table, which is 0.5 foot above to 1.0 foot below the surface from December through May. Runoff is ponded, and the hazard of water erosion is slight. This soil is subject to rare flooding.

This unit is used for hay and pasture (fig. 14) and for wildlife habitat. This unit is suited to hay and pasture. The main limitations are the seasonal wetness, compaction, the high content of clay, and a slow rate of water intake. The wetness limits the choice of suitable forage plants and the period of cutting or grazing and increases the risk of winterkill.

If the pasture is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. The grazing system should maintain the desired balance of species in the plant community. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth.

Tufted hairgrass is the native plant preferred for livestock grazing; however, this unit can be renovated and forage production increased by seeding other suitable grasses. The plants selected for seeding should be those that are tolerant of wetness.

Sprinkler irrigation is the best method of applying water. Border and contour flood irrigation systems also are suitable. Because of the slow rate of water intake and the slow permeability, water applications should be regulated so that the water does not stand on the surface and damage the crop. Land leveling helps to ensure a uniform application of water. Fertilizer is needed to ensure the optimum growth of grasses and

Figure 14.—Livestock grazing in an area of Terrabella clay loam, 0 to 3 percent slopes. Freezener-Geppert complex, 12 to 35 percent south slopes, is in the background.

legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

The vegetative site is Wet Meadow.

193G—Tethrick sandy loam, 35 to 75 percent north slopes. This very deep, well drained soil is on hillslopes. It formed in colluvium derived from granitic rock. Elevation is 1,200 to 4,000 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is dark grayish brown and brown sandy loam about 10 inches thick. The subsoil is yellowish brown and very pale brown sandy loam about 39 inches thick. The substratum to a depth of 60 inches is very pale brown sandy loam. The depth to bedrock is 60 inches or more.

Included in this unit are small areas of Dubakella, Goolaway, and Musty soils; Rock outcrop; Atring and Kanid soils on the more sloping parts of the landscape; and Wolfpeak soils on the less sloping parts of the landscape and on concave slopes. Also included are small areas of Siskiyou soils on ridges, soils that are similar to the Tethrick soil but have bedrock at a depth of 40 to 60 inches, and Tethrick soils that have slopes of less than 35 or more than 75 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderate in the Tethrick soil. Available water capacity is about 6 inches. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir. Other species that grow on this unit include incense cedar, sugar pine, and Pacific madrone. The understory vegetation includes golden chinkapin, cascade Oregongrape, and deerfoot vanillaleaf.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 125. The yield at culmination of the mean annual increment is 7,320 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 58,200 board feet per acre (Scribner rule) at 120 years. On the basis of a 50-year curve, the mean site index is 90.

The main limitations affecting timber production are the slope, erosion, compaction, plant competition, and seedling mortality. When timber is harvested, management that minimizes the risk of erosion is essential. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

This unit is subject to slumping, especially in areas adjacent to drainageways. Road failure and landslides are likely to occur after road construction and clearcutting.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Building the roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings.

Increased erosion, loss of plant nutrients, and water repellency are likely to result from fires of moderate intensity.

The vegetative site is Douglas Fir-Chinkapin Forest.

194G—Tethrick sandy loam, 35 to 75 percent south slopes. This very deep, well drained soil is on hillslopes. It formed in colluvium derived from granitic rock. Elevation is 1,200 to 4,000 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about 1 inch thick. The surface layer is dark grayish brown and brown sandy loam about 10 inches thick. The subsoil is yellowish brown and very pale brown sandy loam about 39 inches thick. The substratum to a depth of 60 inches is very pale brown sandy loam. The depth to bedrock is 60 inches or more.

Included in this unit are small areas of Dubakella, Goolaway, and Musty soils; Rock outcrop; Atring and Kanid soils on the more sloping parts of the landscape; and Wolfpeak soils on the less sloping parts of the landscape and on concave slopes. Also included are small areas of Siskiyou soils on ridges, soils that are similar to the Tethrick soil but have bedrock at a depth of 40 to 60 inches, and Tethrick soils that have slopes of less than 35 or more than 75 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderate in the Tethrick soil. Available water capacity is about 6 inches. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir. Other species that grow on this unit include ponderosa pine, sugar pine, and California black oak. The understory vegetation includes canyon live oak, deerbrush, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 115. The yield at culmination of the mean annual increment is 6,360 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 50,700 board feet per acre (Scribner rule) at 130 years. On the basis of a 50-year curve, the mean site index is 85.

The main limitations affecting timber production are the slope, erosion, compaction, seedling mortality, and plant competition. When timber is harvested, management that minimizes the risk of erosion is essential. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

This unit is subject to slumping, especially in areas adjacent to drainageways. Road failure and landslides are likely to occur after road construction and clearcutting.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Building the roads at midslope requires extensive cutting and filling and removes land from production. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced by providing artificial shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

Increased erosion, loss of plant nutrients, and water repellency are likely to result from fires of moderate intensity.

The vegetative site is Douglas Fir-Black Oak Forest.

195E—Vannoy silt loam, 12 to 35 percent north slopes. This moderately deep, well drained soil is on hillslopes. It formed in colluvium derived dominantly from metamorphic rock. Elevation is 1,000 to 4,000 feet. The mean annual precipitation is 20 to 40 inches, the mean annual temperature is 46 to 54 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about ¾ inch thick. The surface layer is dark brown silt loam about 4 inches thick. The next layer is reddish brown silt loam about 7 inches thick. The subsoil is yellowish red clay loam about 27 inches thick. Weathered bedrock is at a depth of about 38 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is gravelly or very gravelly.

Included in this unit are small areas of Rock outcrop and McMullin soils on ridges and convex slopes; Selmac soils on concave slopes; Caris and Offenbacher soils on the more sloping parts of the landscape; and Manita, Ruch, and Voorhies soils. Also included are small areas of soils that are similar to the Vannoy soil but have bedrock at a depth of more than 40 inches, poorly drained soils near drainageways, and Vannoy soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately slow in the Vannoy soil.

Available water capacity is about 5 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used mainly for timber production. It also is used for pasture and homesite development.

This unit is suited to the production of Douglas fir. Other species that grow on this unit include incense cedar, ponderosa pine, and Pacific madrone. The understory vegetation includes creambush oceanspray, common snowberry, and tall Oregon grape.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 110. The yield at culmination of the mean annual increment is 5,880 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 48,300 board feet per acre (Scribner rule) at 140 years. On the basis of a 50-year curve, the mean site index is 80.

The main limitations affecting timber production are erosion, compaction, plant competition, and seedling mortality. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings.

The main limitations in the areas used as pasture are the slope, erosion, and droughtiness. Seedbeds should be prepared on the contour or across the slope where practical. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

Because of low rainfall in summer, forage production would be increased if this unit were irrigated. Irrigation is difficult, however, because of a limited water supply and the slope.

The main limitations affecting homesite development are the depth to bedrock, the slope, the moderately slow permeability, and low strength. The moderately slow permeability is a limitation on sites for septic tank absorption fields. It can be overcome by increasing the size of the absorption field. Because of the slope, the absorption lines should be installed on the contour. Areas where the soil is deeper and less sloping may be suited to septic tank absorption fields. Onsite investigation is needed to locate such areas.

The slope limits the use of some areas for building site development. Cuts needed to provide essentially level building sites can expose bedrock. Properly designing buildings and roads helps to offset the limited ability of the soil to support a load.

Erosion is a hazard on the steeper slopes. Only the part of the site that is used for construction should be disturbed. Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

The vegetative site is Douglas Fir Forest.

195F—Vannoy silt loam, 35 to 55 percent north slopes. This moderately deep, well drained soil is on hillslopes. It formed in colluvium derived from metamorphic rock. Elevation is 1,000 to 4,000 feet. The mean annual precipitation is 20 to 40 inches, the mean annual temperature is 46 to 54 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about ¾ inch thick. The surface layer is dark brown silt loam about 4 inches thick. The next layer is reddish brown silt loam about 7 inches thick. The subsoil is yellowish red clay loam about 27 inches thick. Weathered bedrock is at a depth of about 38 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is gravelly or very gravelly loam.

Included in this unit are small areas of Voorhies soils, Caris and Offenbacher soils on the more sloping parts of the landscape, McMullin soils and Rock outcrop on ridges and convex slopes, Manita soils on the less sloping parts of the landscape and on concave slopes, and soils that are similar to the Vannoy soil but have bedrock at a depth of more than 40 inches. Also included are small areas of Vannoy soils that have slopes of less than 35 or more than 55 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately slow in the Vannoy soil. Available water capacity is about 5 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir. Other species that grow on this unit include incense cedar, ponderosa pine, and Pacific madrone. The understory vegetation includes creambush oceanspray, common snowberry, and tall Oregon grape.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 110. The yield at culmination of the mean annual increment is 5,880 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 48,300 board feet per acre (Scribner rule) at 140 years. On the basis of a 50-year curve, the mean site index is 80.

The main limitations affecting timber production are the slope, erosion, compaction, plant competition, and seedling mortality. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. When the soil is dry, ripping skid trails and landings improves the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings.

The vegetative site is Douglas Fir Forest.

196E—Vannoy silt loam, 12 to 35 percent south slopes. This moderately deep, well drained soil is on hillslopes. It formed in colluvium derived dominantly from metamorphic rock. Elevation is 1,000 to 4,000 feet. The mean annual precipitation is 20 to 40 inches, the mean annual temperature is 46 to 54 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about ¾ inch thick. The surface layer is dark brown silt loam about 4 inches thick. The next layer is reddish brown silt loam about 7 inches thick. The subsoil is yellowish red clay loam about 27 inches thick. Weathered bedrock is at a depth of about 38 inches. The depth to bedrock ranges from

20 to 40 inches. In some areas the surface layer is gravelly or very gravelly.

Included in this unit are small areas of Rock outcrop and McMullin soils on ridges and convex slopes; Selmac soils on concave slopes; Caris and Offenbacher soils on the more sloping parts of the landscape; and Manita, Ruch, and Voorhies soils. Also included are small areas of soils that are similar to the Vannoy soil but have bedrock at a depth of more than 40 inches, poorly drained soils near drainageways, and Vannoy soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately slow in the Vannoy soil. Available water capacity is about 5 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used mainly for timber production. It also is used for pasture and homesite development.

This unit is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include incense cedar, California black oak, and Pacific madrone. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and California fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 105. The yield at culmination of the mean annual increment is 5,460 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 45,600 board feet per acre (Scribner rule) at 150 years. On the basis of a 50-year curve, the mean site index is 75.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 90. The yield at culmination of the mean annual increment is 3,400 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 37,960 board feet per acre (Scribner rule) at 130 years.

The main limitations affecting timber production are erosion, compaction, seedling mortality, and plant competition. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

The main limitations in the areas used as pasture are the slope, erosion, and droughtiness. Seedbeds should be prepared on the contour or across the slope where practical. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

Because of low rainfall in summer, forage production would be increased if this unit were irrigated. Irrigation is difficult, however, because of a limited water supply and the slope.

The main limitations affecting homesite development are the depth to bedrock, the slope, the moderately slow permeability, and low strength. The moderately slow permeability is a limitation on sites for septic tank absorption fields. It can be overcome by increasing the size of the absorption field. Because of the slope, the absorption lines should be installed on the contour. Areas where the soil is deeper and less sloping may be suited to septic tank absorption fields. Onsite investigation is needed to locate such areas.

The slope limits the use of some areas for building site development. Cuts needed to provide essentially level building sites can expose bedrock. Properly designing buildings and roads helps to offset the limited ability of the soil to support a load.

Erosion is a hazard on the steeper slopes. Only the part of the site that is used for construction should be disturbed. Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

The vegetative site is Pine-Douglas Fir-Fescue.

197F—Vannoy-Voorhies complex, 35 to 55 percent south slopes. This map unit is on hillslopes. Elevation is 1,000 to 4,000 feet. The mean annual precipitation is 20 to 40 inches, the mean annual temperature is 46 to 54 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

This unit is about 60 percent Vannoy soil and 30 percent Voorhies soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of McMullin soils and Rock outcrop on ridges and convex slopes, Caris and Offenbacher soils on the more sloping parts of the landscape, Manita soils on the less sloping parts of the landscape and on concave slopes, and soils that are similar to the Vannoy soil but have bedrock at a depth more than 40 inches. Also included are small areas of Vannoy and Voorhies soils that have slopes of less than 35 or more than 55 percent. Included areas make up about 10 percent of the total acreage.

The Vannoy soil is moderately deep and well drained. It formed in colluvium derived dominantly from metamorphic rock. Typically, the surface is covered with a layer of needles, leaves, and twigs about ¾ inch thick. The surface layer is dark brown silt loam about 4 inches thick. The next layer is reddish brown silt loam about 7 inches thick. The subsoil is yellowish red clay loam about 27 inches thick. Weathered bedrock is at a depth of about 38 inches. The depth to bedrock ranges from 20 to 40 inches. In some areas the surface layer is gravelly or very gravelly loam.

Permeability is moderately slow in the Vannoy soil. Available water capacity is about 5 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

The Voorhies soil is moderately deep and well drained. It formed in colluvium derived dominantly from metamorphic rock. Typically, the surface is covered with a layer of needles and twigs about 1 inch thick. The surface layer is very dark grayish brown and dark brown very gravelly loam about 8 inches thick. The upper 10 inches of the subsoil is brown very gravelly clay loam. The lower 18 inches is brown very cobbly clay loam. Weathered bedrock is at a depth of about 36 inches. The depth to bedrock ranges from 20 to 40 inches.

Permeability is moderate in the Voorhies soil. Available water capacity is about 3 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include incense cedar, California black oak, and Pacific madrone. The understory vegetation includes Pacific serviceberry, tall Oregon grape, and California fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 100 on the Vannoy soil. The yield at culmination of the mean annual increment is 5,040 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 39,750 board feet per acre (Scribner rule) at 150 years. On the basis of a 50-year curve, the mean site index is 75.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 90 on the Vannoy soil. The yield at culmination of the mean annual increment is 3,400 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 37,960 board feet per acre (Scribner rule) at 130 years.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 95 on the Voorhies soil. The yield at culmination of the mean annual increment is 4,620 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 37,120 board feet per acre (Scribner rule) at 160 years. On the basis of a 50-year curve, the mean site index is 65.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 75 on the Voorhies soil. The yield at culmination of the mean annual increment is 3,100 cubic feet per acre in a fully stocked, even-aged stand of trees at 50 years and 31,680 board feet per acre (Scribner rule) at 160 years.

The main limitations affecting timber production are the slope, erosion, compaction, seedling mortality, and plant competition. Also, the bedrock restricts root growth. As a result, windthrow is a hazard.

Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. If the soils are excessively disturbed when timber is harvested or logging roads are built, a large number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soils are moist causes rutting and compaction. Puddling can occur when the soils are wet. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soils are saturated.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. The large number of rock fragments in the Voorhies soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced by providing artificial shade for seedlings. Reforestation can be accomplished by planting Douglas fir and ponderosa pine seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

The vegetative site is Pine-Douglas Fir-Fescue.

198A—Winlo very gravelly clay loam, 0 to 3 percent slopes. This somewhat poorly drained soil is on fan terraces. It is shallow to a hardpan. It formed in alluvium derived from mixed sources. Elevation is 1,100 to 1,500 feet. The mean annual precipitation is 18 to 30 inches, the mean annual temperature is 52 to 54 degrees F, and the average frost-free period is 150 to 180 days. The native vegetation is mainly rushes, sedges, and grasses and scattered water-tolerant hardwoods.

Typically, the surface layer is very dark grayish brown very gravelly clay loam about 4 inches thick. The upper 5 inches of the subsoil is dark brown very gravelly clay. The lower 8 inches is a hardpan. The substratum to a depth of 60 inches is light olive brown extremely gravelly coarse sandy loam. Depth to the hardpan is 7 to 15 inches. The depth to bedrock is 60 inches or more. In some areas the surface layer is very cobbly or very gravelly clay.

Included in this unit are small areas of Agate soils, soils that are similar to the Winlo soil but have a hardpan at a depth of more than 15 inches, and Cove and Padigan soils on concave slopes and near drainageways. Also included are small areas of Winlo soils that have slopes of more than 3 percent. Included areas make up about 20 percent of the total acreage.

Permeability is slow in the Winlo soil. Available water capacity is about 1 inch. The effective rooting depth is 7 to 15 inches. Runoff is ponded, and the hazard of water erosion is slight. The water table is 0.5 foot above to 0.5 foot below the surface from December through February.

This unit is used mainly for pasture. It also is used for homesite development.

The main limitations in the areas used as pasture are wetness in winter and spring, droughtiness in summer and fall, depth to the hardpan, the very gravelly surface layer, and compaction. If the pasture is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. The grazing system should maintain the desired balance of species in the plant community. Wetness limits the choice of suitable forage plants and the period of grazing and increases the risk of winterkill. The use of ground equipment is limited by the gravel and cobbles on the surface.

Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. If possible, periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the depth to a hardpan.

In summer, irrigation is needed for maximum forage production. Sprinkler irrigation is the best method of applying water. Contour flood irrigation also is suitable. Because of the slow permeability and the depth to a hardpan, water applications should be regulated so that the water does not stand on the surface and damage the crop. Land leveling is not practical because of the depth to a hardpan.

Tile drainage systems are not practical because of the depth to a hardpan. Open ditches may be used to reduce surface wetness.

This unit is poorly suited to homesite development. The main limitations are the wetness, depth to the hardpan, and the very gravelly surface layer.

This unit is poorly suited to standard systems of waste disposal because of the wetness and the depth to a hardpan. Alternative waste disposal systems may function properly on this unit. Suitable included soils are in some areas of the unit. Onsite investigation is needed to locate such soils.

Because the seasonal high water table is perched above the hardpan, a drainage system is needed on sites for buildings with basements and crawl spaces. A drainage system also is needed if roads or building foundations are constructed. Excess water can be removed by suitably designed drainage ditches.

Cuts needed to provide essentially level building sites can expose the hardpan. Establishing plants is difficult in areas where the hardpan has been exposed. Mulching and applying fertilizer help to establish plants in cut areas. Gravel and cobbles should be removed from disturbed areas, particularly areas used for lawns. In many areas it may be necessary to haul in topsoil for lawns and gardens. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

The vegetative site is Poorly Drained Bottom.

199C—Wolfpeak sandy loam, 3 to 12 percent slopes. This very deep, well drained soil is on alluvial fans. It formed in residuum and alluvium derived dominantly from granitic rock. Elevation is 1,200 to 4,000 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about ½ inch thick. The surface layer is dark brown sandy loam about 4 inches thick. The next layer is brown sandy loam about 7 inches thick. The subsoil to a depth of 60 inches is yellowish brown and strong brown clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is clay loam.

Included in this unit are small areas of Clawson soils near drainageways and on concave slopes, Josephine and Pollard soils, and soils that are similar to the Wolfpeak soil but have bedrock within a depth of 60 inches. Also included are small areas of Wolfpeak soils that have slopes of more than 12 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderately slow in the Wolfpeak soil. Available water capacity is about 8 inches. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is moderate.

This unit is used mainly for timber production or wildlife habitat. It also is used for hay and pasture and for homesite development.

This unit is suited to irrigation crops. It is limited mainly by the moderately slow permeability and the hazard of erosion. In summer, irrigation is needed for the maximum production of most crops. Sprinkler irrigation is the best method of applying water. This method permits an even, controlled application of water, helps to prevent excessive runoff, and minimizes the risk of erosion. Border and contour flood irrigation systems also are suitable. For the efficient application and removal of surface irrigation water, land leveling is needed. To prevent overirrigation and excessive erosion, applications of irrigation water should be adjusted to the available water capacity, the rate of water intake, and the needs of the crop. The use of pipe, ditch lining, or drop structures in irrigation ditches reduces water loss and the hazard of erosion.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Leaving crop residue on or near the surface helps to conserve moisture and control erosion.

A tillage pan forms easily if the soil is tilled when wet. Chiseling or subsoiling breaks up the pan. Surface crusting and compaction can be minimized by returning crop residue to the soil.

Seedbeds should be prepared on the contour or across the slope where practical. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep pastures in good condition and protect the soil from erosion. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Periodic mowing and clipping help to maintain uniform plant growth, discourage selective grazing, and reduce the extent of clumpy growth. Fertilizer is needed to ensure the optimum growth of grasses and legumes. Grasses respond to nitrogen, and legumes respond to sulfur and phosphorus.

This unit is well suited to homesite development. The main limitations are the moderately slow permeability and the shrink-swell potential. The moderately slow permeability is a limitation on sites for septic tank absorption fields. It can be overcome by increasing the size of the absorption field.

If buildings are constructed on this unit, properly designing foundations and footings, diverting runoff away from the buildings, and backfilling with material that has a low shrink-swell potential help to prevent the structural damage caused by shrinking and swelling. Properly designing buildings and roads helps to offset the limited ability of the soil to support a load.

Revegetating as soon as possible helps to control erosion in disturbed areas around construction sites. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. Because of a low amount of rainfall in summer, irrigation is needed in areas that support lawn grasses, shrubs, vines, shade trees, or ornamental trees.

This unit is suited to the production of Douglas fir. Other species that grow on this unit include ponderosa pine, incense cedar, and sugar pine. The understory vegetation includes golden chinkapin, cascade Oregongrape, and deerfoot vanillaleaf.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 130. The yield at culmination of the mean annual increment is 7,740 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 58,520 board feet per acre (Scribner rule) at 110 years. On the basis of a 50-year curve, the mean site index is 95.

The main limitations affecting timber production are compaction, erosion, plant competition, and seedling mortality. When timber is harvested, management that minimizes the risk of erosion is essential. Conventional methods of harvesting timber generally are suitable, but the soil may be compacted if it is moist when heavy equipment is used. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Erosion can be controlled by carefully planning the construction and maintenance of logging roads, skid trails, and landings. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings.

Increased erosion, loss of plant nutrients, and water repellency are likely to result from fires of moderate intensity.

The vegetative site is Douglas Fir-Chinkapin Forest.

200E—Wolfpeak sandy loam, 12 to 35 percent north slopes. This very deep, well drained soil is on hillslopes. It formed in colluvium and residuum derived from granitic rock. Elevation is 1,200 to 4,000 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about ½ inch thick. The surface layer is dark brown sandy loam about 4 inches thick. The next layer is brown sandy loam about 7 inches thick. The subsoil to a depth of 60 inches is yellowish brown and strong brown clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is clay loam.

Included in this unit are small areas of Josephine, Goolaway, Musty, and Pollard soils; Tethrick soils on the more sloping parts of the landscape; and Siskiyou soils on ridges and convex slopes. Also included are small areas of poorly drained soils near drainageways and on concave slopes, soils that are similar to the Wolfpeak soil but have bedrock within a depth of 60 inches, and Wolfpeak soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately slow in the Wolfpeak soil. Available water capacity is about 8 inches. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate or high.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir. Other species that grow on this unit include incense cedar, sugar pine, and Pacific madrone. The understory vegetation includes golden chinkapin, cascade Oregongrape, and deerfoot vanillaleaf.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 130. The yield at culmination of the mean annual increment is 7,740 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 58,520 board feet per acre (Scribner rule) at 110 years. On the basis of a 50-year curve, the mean site index is 95.

The main limitations affecting timber production are erosion, compaction, plant competition, and seedling mortality. When timber is harvested, management that minimizes the risk of erosion is essential. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

This unit is subject to slumping, especially in areas adjacent to drainageways. Road failure and landslides are likely to occur after road construction and clearcutting. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting Douglas fir seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings.

Increased erosion, loss of plant nutrients, and water repellency are likely to result from fires of moderate intensity.

The vegetative site is Douglas Fir-Chinkapin Forest.

201E—Wolfpeak sandy loam, 12 to 35 percent south slopes. This very deep, well drained soil is on hillslopes. It formed in colluvium and residuum derived from granitic rock. Elevation is 1,200 to 4,000 feet. The mean annual precipitation is 40 to 50 inches, the mean annual temperature is 45 to 52 degrees F, and the average frost-free period is 100 to 160 days. The native vegetation is mainly conifers and hardwoods and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles, leaves, and twigs about ½ inch thick. The surface layer is dark brown sandy loam about 4 inches thick. The next layer is brown sandy loam about 7 inches thick. The subsoil to a depth of 60 inches is yellowish brown and strong brown clay loam. The depth to bedrock is 60 inches or more. In some areas the surface layer is clay loam.

Included in this unit are small areas of Josephine, Goolaway, Musty, and Pollard soils; Tethrick soils on the more sloping parts of the landscape; and Siskiyou soils on ridges and convex slopes. Also included are small areas of poorly drained soils near drainageways and on concave slopes, soils that are similar to the Wolfpeak soil but have bedrock within a depth of 60 inches, and Wolfpeak soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderately slow in the Wolfpeak soil. Available water capacity is about 8 inches. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate or high.

This unit is used for timber production and wildlife habitat. It is suited to the production of Douglas fir. Other species that grow on this unit include ponderosa pine, sugar pine, and California black oak. The understory vegetation includes canyon live oak, deerbrush, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 120. The yield at culmination of the mean annual increment is 6,900 cubic feet per acre in a fully stocked, even-aged stand of trees at 60 years and 31,840 board feet per acre (Scribner rule) at 160 years. On the basis of a 50-year curve, the mean site index is 85.

The main limitations affecting timber production are erosion, compaction, seedling mortality, and plant competition. When timber is harvested, management that minimizes the risk of erosion is essential. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Areas that have been cut and filled are easily eroded unless they are treated. Seeding, mulching, and benching these areas help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use. Cutbanks occasionally slump when the soil is saturated.

This unit is subject to slumping, especially in areas adjacent to drainageways. Road failure and landslides are likely to occur after road construction and clearcutting. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced by providing artificial shade for seedlings. Reforestation can be accomplished by planting Douglas fir seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

Increased erosion, loss of plant nutrients, and water repellency are likely to result from fires of moderate intensity.

The vegetative site is Douglas Fir-Black Oak Forest.

202F—Woodcock stony loam, 35 to 55 percent north slopes. This very deep, well drained soil is on hillslopes. It formed in colluvium derived from andesite. Elevation is 3,800 to 6,500 feet. The mean annual precipitation is 25 to 35 inches, the mean annual temperature is 40 to 43 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles and twigs about 1 inch thick. The surface layer is dark reddish brown stony loam about 4 inches thick. The next layer is dark reddish brown very gravelly loam about 12 inches thick. The subsoil is dark reddish brown very gravelly clay loam about 23 inches thick. The substratum to a depth of 62 inches is dark reddish brown gravelly clay loam. The depth to bedrock is 60 inches or more.

Included in this unit are small areas of Merlin soils and Rock outcrop on ridges and convex slopes, Pokegema soils on the less sloping parts of the landscape, and soils that are similar to the Woodcock soil but have bedrock within a depth of 60 inches. Also included are small areas of Woodcock soils that have slopes of less than 35 or more than 55 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Woodcock soil. Available water capacity is about 4 inches. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include white fir, incense cedar, and sugar pine. The understory vegetation includes sierra chinkapin, tall Oregon grape, and western fescue.

On the basis of a 100-year site curve, the mean site index is 110 for Douglas fir and 105 for ponderosa pine. The yield of ponderosa pine at culmination of the mean annual increment is 4,480 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 50,040 board feet per acre (Scribner rule) at 120 years.

The main limitations affecting timber production are the slope, erosion, compaction, and plant competition. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting ponderosa pine and Douglas fir seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

The main limitations affecting livestock grazing are erosion, compaction, and the slope. The native vegetation suitable for grazing includes western fescue, sedge, mountain brome, and tall trisetum. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Conifer-Chinkapin-Sedge Forest.

203F—Woodcock stony loam, 35 to 55 percent south slopes. This very deep, well drained soil is on hillslopes. It formed in colluvium derived from andesite. Elevation is 3,800 to 6,500 feet. The mean annual precipitation is 25 to 35 inches, the mean annual temperature is 40 to 43 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

Typically, the surface is covered with a layer of needles and twigs about 1 inch thick. The surface layer is dark reddish brown stony loam about 4 inches thick. The next layer is dark reddish brown very gravelly loam about 12 inches thick. The subsoil is dark reddish brown very gravelly clay loam about 23 inches thick. The substratum to a depth of 62 inches is dark reddish brown gravelly clay loam. The depth to bedrock is 60 inches or more.

Included in this unit are small areas of Merlin soils and Rock outcrop on ridges and convex slopes, Pokegema soils on the less sloping parts of the landscape, and soils that are similar to the Woodcock soil but have bedrock within a depth of 60 inches. Also included are small areas of Woodcock soils that have slopes of less than 35 or more than 55 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Woodcock soil. Available water capacity is about 4 inches. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include white fir, incense cedar, and sugar pine. The understory vegetation includes sierra chinkapin, tall Oregon grape, and western fescue.

On the basis of a 100-year site curve, the mean site index is 105 for Douglas fir and 95 for ponderosa pine. The yield of ponderosa pine at culmination of the mean annual increment is 3,760 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 43,160 board feet per acre (Scribner rule) at 130 years.

The main limitations affecting timber production are the slope, erosion, compaction, seedling mortality, and plant competition. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer and results in less surface disturbance. If the soil is excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. Puddling can occur when the soil is wet. Using low-pressure ground equipment causes less damage to the soil and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction. Ripping skid trails and landings when the soil is dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Cutbanks occasionally slump when the soil is saturated.

Constructing logging roads on the steeper slopes can result in a high risk of erosion. Material that is discarded when the roads are built can damage vegetation and is a potential source of sedimentation. If the material becomes saturated, avalanches of debris can occur. End hauling of the waste material minimizes damage to the vegetation downslope and reduces the risk of sedimentation. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

A high temperature in the surface layer during summer and the low available water capacity increase the seedling mortality rate. The large number of rock fragments in the soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings. The seedling mortality rate also can be reduced by providing artificial shade for seedlings. Reforestation can be accomplished by planting ponderosa pine and Douglas fir seedlings.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

The main limitations affecting livestock grazing are erosion, compaction, and the slope. The native vegetation suitable for grazing includes western fescue, sedge, mountain brome, and tall trisetum. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soil. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Conifer-Chinkapin-Sedge Forest.

204E—Woodcock-Pokegema complex, 12 to 35 percent north slopes. This map unit is on hillslopes. Elevation is 3,800 to 6,500 feet. The mean annual precipitation is 25 to 35 inches, the mean annual temperature is 40 to 43 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

This unit is about 60 percent Woodcock soil and 25 percent Pokegema soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Merlin soils and Rock outcrop on ridges and convex slopes, Klamath soils near drainageways and on concave slopes, soils that are similar to the Woodcock soil but have bedrock within a depth of 60 inches, and soils that are similar to the Pokegema soil but have bedrock at a depth of less than 40 or more than 60 inches. Also included are small areas of Woodcock and Pokegema soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 15 percent of the total acreage.

The Woodcock soil is very deep and well drained. It formed in colluvium derived dominantly from andesite. Typically, the surface is covered with a layer of needles and twigs about 1 inch thick. The surface layer is dark reddish brown stony loam about 4 inches thick. The next layer is dark reddish brown very gravelly loam about 12 inches thick. The subsoil is dark reddish brown very gravelly clay loam about 23 inches thick. The substratum to a depth of 62 inches is dark reddish brown gravelly clay loam. The depth to bedrock is 60 inches or more.

Permeability is moderate in the Woodcock soil. Available water capacity is about 4 inches. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

The Pokegema soil is deep and well drained. It formed in colluvium derived dominantly from andesite. Typically, the surface is covered with a layer of needles and twigs about ½ inch thick. The surface layer is dark reddish brown loam about 8 inches thick. The upper 8 inches of the subsoil is dark reddish brown clay loam. The lower 22 inches is dark reddish brown gravelly clay. The substratum is dark reddish brown and reddish brown gravelly clay about 14 inches thick. Weathered bedrock is at a depth of about 52 inches. The depth to bedrock ranges from 40 to 60 inches. In some areas the surface layer is stony.

Permeability is moderately slow in the Pokegema soil. Available water capacity is about 6 inches. The effective rooting depth is 40 to 60 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include white fir, incense cedar, and sugar pine. The understory vegetation includes sierra chinkapin, tall Oregon grape, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 110 on the Woodcock soil and 120 on the Pokegema soil.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 105 on both the Woodcock and Pokegema soils. The yield at culmination of the mean annual increment is 4,480 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 50,040 board feet per acre (Scribner rule) at 120 years.

The main limitations affecting timber production are erosion, compaction, and plant competition. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. If the soils are excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soils are moist causes rutting and compaction. Puddling can occur when the soils are wet. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting ponderosa pine and Douglas fir seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

Severe frost can damage or kill seedlings. In the less sloping areas where air drainage may be restricted, proper timber harvesting methods can reduce the effect of frost on regeneration.

The main limitations affecting livestock grazing are compaction and erosion. The native vegetation suitable for grazing includes western fescue, sedge, mountain brome, and tall trisetum. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soils. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Conifer-Chinkapin-Sedge Forest.

205E—Woodcock-Pokegema complex, 12 to 35 percent south slopes. This map unit is on hillslopes. Elevation is 3,800 to 6,500 feet. The mean annual precipitation is 25 to 35 inches, the mean annual temperature is 40 to 43 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

This unit is about 60 percent Woodcock soil and 25 percent Pokegema soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Merlin soils and Rock outcrop on ridges and convex slopes, Klamath soils near drainageways and on concave slopes, soils that are similar to the Woodcock soil but have bedrock within a depth of 60 inches, and soils that are similar to the Pokegema soil but have bedrock at a depth of less than 40 or more than 60 inches. Also included are small areas of Woodcock and Pokegema soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 15 percent of the total acreage.

The Woodcock soil is very deep and well drained. It formed in colluvium derived dominantly from andesite. Typically, the surface is covered with a layer of needles and twigs about 1 inch thick. The surface layer is dark reddish brown stony loam about 4 inches thick. The next layer is dark reddish brown very gravelly loam about 12 inches thick. The subsoil is dark reddish brown very gravelly clay loam about 23 inches thick. The substratum to a depth of 62 inches is dark reddish brown gravelly clay loam. The depth to bedrock is 60 inches or more.

Permeability is moderate in the Woodcock soil. Available water capacity is about 4 inches. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

The Pokegema soil is deep and well drained. It formed in colluvium derived dominantly from andesite. Typically, the surface is covered with a layer of needles and twigs about ½ inch thick. The surface layer is dark reddish brown loam about 8 inches thick. The upper 8 inches of the subsoil is dark reddish brown clay loam. The lower 22 inches is dark reddish brown gravelly clay. The substratum is dark reddish brown and reddish brown gravelly clay about 14 inches thick. Weathered bedrock is at a depth of about 52 inches. The depth to bedrock ranges from 40 to 60 inches. In some areas the surface layer is stony.

Permeability is moderately slow in the Pokegema soil. Available water capacity is about 6 inches. The effective rooting depth is 40 to 60 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include white fir, incense cedar, and sugar pine. The understory vegetation includes sierra chinkapin, tall Oregon grape, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 105 on the Woodcock soil and 120 on the Pokegema soil.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 95 on the Woodcock soil. The yield at culmination of the mean annual increment is 3,760 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 43,160 board feet per acre (Scribner rule) at 130 years.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 105 on the Pokegema soil. The yield at culmination of the mean annual increment is 4,480 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 50,040 board feet per acre (Scribner rule) at 120 years.

The main limitations affecting timber production are erosion, compaction, plant competition, and seedling mortality. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. If the soils are excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soils are moist causes rutting and compaction. Puddling can occur when the soils are wet. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting ponderosa pine and Douglas fir seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. The large number of rock fragments in the Woodcock soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings.

Severe frost can damage or kill seedlings. In the less sloping areas where air drainage may be restricted, proper timber harvesting methods can reduce the effect of frost on regeneration.

The main limitations affecting livestock grazing are compaction and erosion. The native vegetation suitable for grazing includes western fescue, sedge, mountain brome, and tall trisetum. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soils. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Conifer-Chinkapin-Sedge Forest.

206E—Woodcock-Pokegema complex, warm, 12 to 35 percent slopes. This map unit is on hillslopes. It is mainly on south-facing slopes. Elevation is 4,300 to 5,400 feet. The mean annual precipitation is 25 to 35 inches, the mean annual temperature is 43 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly conifers and an understory of grasses, shrubs, and forbs.

This unit is about 60 percent Woodcock soil and 25 percent Pokegema soil. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Merlin soils and Rock outcrop on ridges and convex slopes, Klamath soils near drainageways and on concave slopes, soils that are similar to the Woodcock soil but have bedrock within a depth of 60 inches, and soils that are similar to the Pokegema soil but have bedrock at a depth of less than 40 or more than 60 inches. Also included are small areas of Woodcock and Pokegema soils that have slopes of less than 12 or more than 35 percent. Included areas make up about 15 percent of the total acreage.

The Woodcock soil is very deep and well drained. It formed in colluvium derived dominantly from andesite. Typically, the surface is covered with a layer of needles and twigs about 1 inch thick. The surface layer is dark reddish brown stony loam about 4 inches thick. The next layer is dark reddish brown very gravelly loam about 12 inches thick. The subsoil is dark reddish brown very gravelly clay loam about 23 inches thick. The substratum to a depth of 62 inches is dark reddish brown gravelly clay loam. The depth to bedrock is 60 inches or more.

Permeability is moderate in the Woodcock soil. Available water capacity is about 4 inches. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

The Pokegema soil is deep and well drained. It formed in colluvium derived dominantly from andesite. Typically, the surface is covered with a layer of needles and twigs about ½ inch thick. The surface layer is dark reddish brown loam about 8 inches thick. The upper 8 inches of the subsoil is dark reddish brown clay loam. The lower 22 inches is dark reddish brown gravelly clay. The substratum is dark reddish brown and reddish brown gravelly clay about 14 inches thick. Weathered bedrock is at a depth of about 52 inches. The depth to bedrock ranges from 40 to 60 inches. In some areas the surface layer is stony.

Permeability is moderately slow in the Pokegema soil. Available water capacity is about 6 inches. The effective rooting depth is 40 to 60 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for timber production, livestock grazing, and wildlife habitat.

This unit is suited to the production of Douglas fir and ponderosa pine. Other species that grow on this unit include white fir, incense cedar, and sugar pine. The understory vegetation includes sierra chinkapin, antelope bitterbrush, and western fescue.

On the basis of a 100-year site curve, the mean site index for Douglas fir is 105 on the Woodcock soil and 120 on the Pokegema soil.

On the basis of a 100-year site curve, the mean site index for ponderosa pine is 95 on the Woodcock soil. The yield at culmination of the mean annual increment is 3,760 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 43,160 board feet per acre (Scribner rule) at 130 years.

On the basis of a 100-year site curve, the mean site

index for ponderosa pine is 105 on the Pokegema soil. The yield at culmination of the mean annual increment is 4,480 cubic feet per acre in a fully stocked, even-aged stand of trees at 40 years and 50,040 board feet per acre (Scribner rule) at 120 years.

The main limitations affecting timber production are erosion, compaction, plant competition, and seedling mortality. Wheeled and tracked logging equipment can be used in the less sloping areas, but cable yarding generally is safer in the more sloping areas and results in less surface disturbance. If the soils are excessively disturbed when timber is harvested or logging roads are built, a larger number of rock fragments is left on the surface. Using standard wheeled and tracked equipment when the soils are moist causes rutting and compaction. Puddling can occur when the soils are wet. Using low-pressure ground equipment causes less damage to the soils and helps to maintain productivity. Compaction can be minimized by using suitable methods of harvesting, laying out skid trails in advance, and harvesting timber when the soils are least susceptible to compaction. Ripping skid trails and landings when the soils are dry can improve the growth of plants.

Properly designed road drainage systems that include carefully located culverts help to control erosion. Seeding, mulching, and benching areas that have been cut and filled also help to control erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless they are protected by a plant cover or adequate water bars, or both. Skid trails and unsurfaced roads may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

Undesirable plants limit natural or artificial reforestation unless intensive site preparation and maintenance measures are applied. Reforestation can be accomplished by planting ponderosa pine and Douglas fir seedlings. Mulching around seedlings helps to maintain the moisture supply in summer and minimizes competition from undesirable plants.

A high temperature in the surface layer and an insufficient moisture supply in summer increase the seedling mortality rate. The large number of rock fragments in the Woodcock soil also increases the seedling mortality rate. To compensate for the expected high mortality rate, the larger seedlings or a greater number of seedlings should be planted. When the timber is harvested, leaving some of the larger trees unharvested provides shade for seedlings.

Severe frost can damage or kill seedlings. In the less sloping areas where air drainage may be restricted, proper timber harvesting methods can reduce the effect of frost on regeneration.

The main limitations affecting livestock grazing are compaction and erosion. The native vegetation suitable for grazing includes western fescue, sedge, mountain brome, and tall trisetum. If the understory is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases.

A planned grazing system that includes timely deferment of grazing, rotation grazing, and proper livestock distribution helps to prevent overgrazing of the understory and damage to the soils. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soils are firm enough to withstand trampling by livestock.

Thinning, logging, and fire reduce the density of the overstory canopy and increase the production of understory vegetation. Areas that support a large amount of competing vegetation can be improved by prescribed burning or by chemical or mechanical treatment. Seeding disturbed areas to suitable plants increases forage production and reduces the risk of erosion.

The vegetative site is Mixed Conifer-Bitterbrush-Sedge Forest.

207E—Woodseye-Rock outcrop complex, 3 to 35 percent slopes. This map unit is on hillslopes. Elevation is 4,000 to 6,000 feet. The mean annual precipitation is 30 to 55 inches, the mean annual temperature is 40 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly grasses, shrubs, and forbs.

This unit is about 65 percent Woodseye soil and 25 percent Rock outcrop. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Farva, Pinehurst, Rustlerpeak, Snowlin, and Tatouche soils; poorly drained soils near drainageways and on concave slopes; and soils that are similar to the Woodseye soil but have bedrock at a depth of less than 10 or more than 20 inches. Also included are small areas of Woodseye soils that have slopes of more than 35 percent. Included areas make up about 10 percent of the total acreage.

The Woodseye soil is shallow and somewhat excessively drained. It formed in colluvium derived dominantly from andesite. Typically, the surface layer is dark brown very stony loam about 2 inches thick. The next layer is dark brown very cobbly loam about 6 inches thick. The subsoil also is dark brown very cobbly loam. It is about 10 inches thick. Bedrock is at a depth of about 18 inches. The depth to bedrock ranges from 10 to 20 inches.

Permeability is moderate in the Woodseye soil. Available water capacity is about 1 inch. The effective rooting depth is 10 to 20 inches. Runoff is slow or medium, and the hazard of water erosion is slight or moderate.

Rock outcrop consists of areas of exposed bedrock. Runoff is very rapid in these areas.

This unit is used for livestock grazing and wildlife habitat. The main limitations affecting livestock grazing are compaction, erosion, the Rock outcrop, stones on the surface, droughtiness, and the depth to bedrock. The vegetation suitable for grazing includes Idaho fescue, pine bluegrass, and bluebunch wheatgrass. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment. The use of ground equipment is not practical because of the stones on the surface and the Rock outcrop.

This unit is poorly suited to range seeding. The main limitations are the depth to bedrock, droughtiness, the Rock outcrop, and the stones on the surface. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the slope and the depth to bedrock.

The vegetative site is Loamy Juniper Scabland, 20- to 30-inch precipitation zone.

207G—Woodseye-Rock outcrop complex, 35 to 80 percent slopes. This map unit is on hillslopes. Elevation is 4,000 to 6,000 feet. The mean annual precipitation is 30 to 55 inches, the mean annual temperature is 40 to 45 degrees F, and the average frost-free period is less than 100 days. The native vegetation is mainly grasses, shrubs, and forbs.

This unit is about 60 percent Woodseye soil and 30 percent Rock outcrop. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the scale used.

Included in this unit are small areas of Farva, Pinehurst, Rustlerpeak, Snowlin, and Tatouche soils; poorly drained soils near drainageways and on concave slopes; and soils that are similar to the Woodseye soil but have bedrock at a depth of less than 10 or more than 20 inches. Also included are small areas of Woodseye soils that have slopes of less than 35 or more than 80 percent. Included areas make up about 10 percent of the total acreage.

The Woodseye soil is shallow and somewhat excessively drained. It formed in colluvium derived dominantly from andesite. Typically, the surface layer is dark brown very stony loam about 2 inches thick. The next layer is dark brown very cobbly loam about 6 inches thick. The subsoil also is dark brown very cobbly loam. It is about 10 inches thick. Bedrock is at a depth of about 18 inches. The depth to bedrock ranges from 10 to 20 inches.

Permeability is moderate in the Woodseye soil. Available water capacity is about 1 inch. The effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is high.

Rock outcrop consists of areas of exposed bedrock. Runoff is very rapid in these areas.

This unit is used for livestock grazing and wildlife habitat. The main limitations affecting livestock grazing are the slope, erosion, compaction, the Rock outcrop, stones on the surface, droughtiness, and the depth to bedrock. The vegetation suitable for grazing includes Idaho fescue, pine bluegrass, and bluebunch wheatgrass. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Grazing should be delayed until the more desirable forage plants have achieved enough growth to withstand grazing pressure and the soil is firm enough to withstand trampling by livestock.

Suitable management practices on this unit include proper grazing use, deferred grazing, rotation grazing, and brush control. Areas that support a large amount of competing vegetation can be improved by chemical or mechanical treatment. The use of ground equipment is not practical because of the stones on the surface, the Rock outcrop, and the slope.

This unit is poorly suited to range seeding. The main limitations are the slope, droughtiness, the depth to bedrock, the Rock outcrop, and the stones on the surface. The plants selected for seeding should be those that meet the seasonal requirements of livestock or wildlife, or both.

The slope and the Rock outcrop limit access by livestock. As a result, the less sloping areas tend to be overgrazed. Constructing trails or walkways allows livestock to graze in areas where access is limited.

This unit is limited as a site for livestock watering ponds and other water impoundments because of the slope and the depth to bedrock.

The vegetative site is Loamy Juniper Scabland, 20- to 30-inch precipitation zone.

208C—Xerorthents-Dumps complex, 0 to 15 percent slopes. This map unit is in areas on flood plains, stream terraces, and alluvial fans where excavated material was deposited during mining operations. The material in this unit commonly is referred to as mine tailings. Slopes range from nearly level to hummocky. Elevation is 1,000 to 4,100 feet. The mean annual precipitation is 20 to 50 inches, the mean annual temperature is 43 to 54 degrees F, and the average frost-free period is 100 to 180 days. The vegetation on the Xerorthents is mainly scattered conifers and hardwoods and a sparse understory of grasses, shrubs, and forbs. The Dumps support very little, if any, vegetation.

This unit is about 35 percent Xerorthents and 30 percent Dumps.

Included in this unit are small areas of Camas, Evans, and Newberg soils on flood plains; Central Point, Foehlin, Medford, and Takilma soils on terraces; and Abegg, Josephine, Ruch, Shefflein, and Dumont soils on alluvial fans. Included areas make up about 35 percent of the total acreage.

The Xerorthents vary too considerably to be classified at the series level. They are cobbly clay loam to extremely cobbly sandy loam and have as much as 90 percent gravel, cobbles, and stones.

The Dumps consist mostly of gravel, cobbles, and stones and include little, if any, material of finer texture.

Permeability, available water capacity, and the effective rooting depth vary considerably in areas of this unit. There is a seasonal high water table in winter and spring, particularly in areas on flood plains.

This unit is a potential source of gravel. Most areas are limited as sites for other uses.

This unit is not assigned to a vegetative site.