United States
Department of
Agriculture

Natural
Resources
Conservation
Service

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

Soil Survey of Baker County Area, Oregon

How To Use This Soil Survey

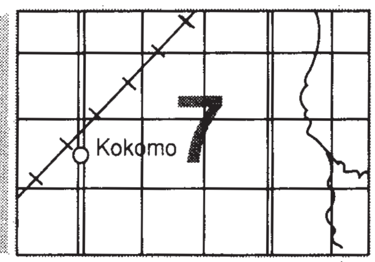
General Soil Map

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.

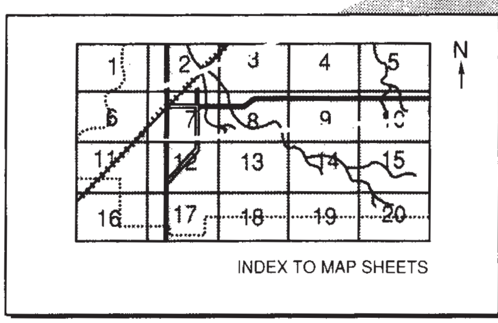
Detailed Soil Maps

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



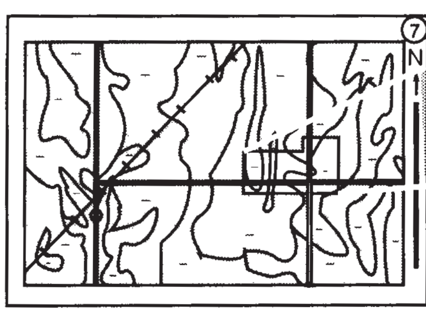
MAP SHEET

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.

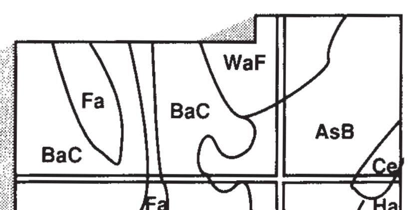


INDEX TO MAP SHEETS

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 Natural Resources Conservation Service (formerly the Soil Conservation Service) has leadership for the federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, handicap, or age.

Major fieldwork for this soil survey was completed in 1987. Soil names and descriptions were approved in 1988. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1987. This survey was made cooperatively by the Natural Resources Conservation Service, the Bureau of Land Management, the Forest Service, and the Oregon Agricultural Experiment Station. The survey is part of the technical assistance furnished to the Baker Valley, Burnt River, Eagle Valley, and Keating Soil and Water Conservation Districts.

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

Cover: Foreground — alfalfa on Goodrich gravelly loam, 2 to 7 percent slopes; background — east side of the Elkhorn Mountain Range

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Foreword

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

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

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

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

Jack P. Kanalz
State Conservationist
Soil Conservation Service

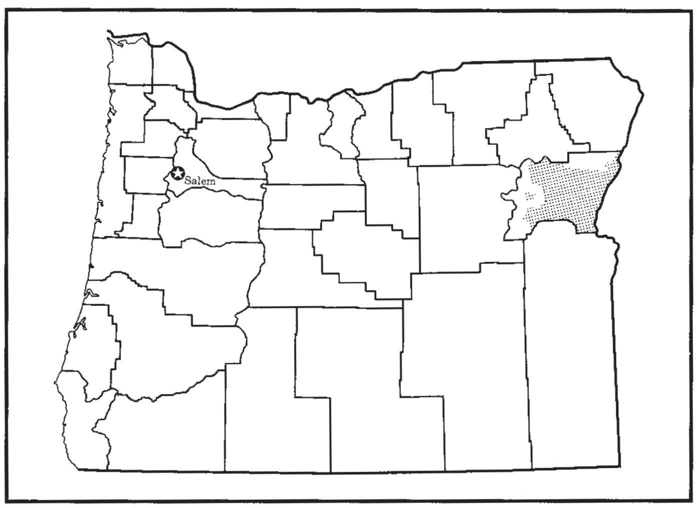

Figure 1.—Location of Baker County Area in Oregon.

Soil Survey of
Baker County Area, Oregon

By William E. Laird, Natural Resources Conservation Service

Fieldwork by William E. Laird, Matthew H. Fillmore, Gerald D. Macdonald, and Delbert P. Christenson, Natural Resources Conservation Service; and Arthur E. Kreger, Forest Service

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

BAKER COUNTY AREA is in the northeastern part of Oregon. Baker City, the county seat, has a population of about 9,500. The survey area is 1,345,100 acres. Private land makes up about 944,100 acres, or about 1,475 square miles. Of the public lands, 365,000 acres is managed by the U.S. Bureau of Land Management and 36,000 acres by the U.S. Forest Service.

The survey area is mainly that part of Baker County that is not in the Wallowa-Whitman National Forest, but the survey area does include National Forest land in the Dooley Mountain area. This survey is an update to the soil survey of Baker Area published in 1941 (*24*).

The average annual precipitation in the Baker County Area ranges from 9 to 40 inches. Elevation ranges from 1,800 feet at the Snake River to over 8,000 feet in the Blue Mountains. The survey area is mainly in the Upper Snake River Lava Plains and Hills Major Land Resource Area (MLRA), but the higher elevation forestland is in the Northern Rocky Mountains MLRA and part of the survey area northeast of Richland is in the Palouse and Nez Perce Prairies MLRA (*28*).

About two-thirds of the survey area is rangeland, and livestock grazing is the primary land use. An additional one-sixth of the area is forest that mainly is used as a source of timber and for summer livestock grazing. Most of the remaining area is cropland and pasture. The main crops are hay and pasture and small grains. Most of the cropland and pasture is irrigated by gravity flood systems or gravity sprinkler systems.

General Nature of the Survey Area

This section briefly describes the survey area's history; physiography, relief, and drainage; and climate.

History

Between 1842 and 1847 many immigrants on their way to the Willamette Valley followed the old Oregon Trail across the survey area. The first settlement in the area, a mining camp at Sumpter, was established in the early 1850's by miners seeking gold in the Blue Mountains. Prospecting in that area began after the first gold rush in California had partly subsided. The discovery of gold at Griffins Gulch, west of Baker City, in 1861 brought a great influx of settlers the following year. A large settlement was made at Auburn. By this time an extensive camp had been established at Sumpter, and smaller settlements had been made near other placer mines.

Baker County was organized in 1862. Two years later Union County was formed from a part of northern Baker County, and in 1887 Malheur County was formed from a part of southern Baker County. Farming began in

1863 to supply produce for the miners, but most other supplies were hauled over the Blue Mountains from Umatilla on the Columbia River. Hauling continued until 1883, when rail traffic was opened by the Oregon-Washington Railroad & Navigation Co., now part of the Union Pacific system.

Farming began in Sumpter Valley in 1863 and from there spread to Baker City and other valleys. In early years farming was intermittent because gold mining was of first interest; many settlers divided their time between mining and farming. At first, the farming mainly consisted of raising livestock, but potatoes, other vegetables, grains, and hardy fruits were soon planted to meet the growing demand in the mining camps.

Agricultural development was gradual for the first 20 years after settlement began. The range was stocked with cattle and sheep, irrigation ditches were dug, and the more accessible land was brought under cultivation. Much native grass was cut for hay. Many cattle and horses were driven from the area to replace Texas longhorns on the Montana range. Many finished beef cattle were driven to Winnemucca, Nevada, for shipment to Omaha, Nebraska, and a few were driven to Portland, Oregon. Crops and farm produce were grown mostly for local consumption because adequate transportation to outside markets was lacking. After construction of the railroad in 1883, agricultural development was fairly rapid.

Since the Dust Bowl of the 1930's, interest in soil conservation in the area has increased. In 1941, the Keating Soil and Water Conservation District (SWCD) was organized. It is the fifth oldest SWCD in Oregon. This was followed in 1944 by the Eagle Valley SWCD, in 1947 by the Baker Valley SWCD, and in 1949 by the Burnt River SWCD.

Physiography, Relief, and Drainage

The survey area is made up of six large valleys separated by rangeland and higher mountainous areas. The valleys are Baker, Burnt River, Eagle, Lower Powder, Pine, and Sumpter. The valleys and adjoining terraces and fans cover about 215,216 acres, or 16 percent of the survey area; the intervening rangelands cover about 901,217 acres, or 67 percent; and the higher elevation forestlands cover about 228,667 acres, or 17 percent of the survey area.

The Baker, Lower Powder, and Sumpter Valleys are drained by the Powder River or its tributaries. Pine Valley is drained by Pine Creek, which flows east into the Snake River. Eagle Valley is drained by Eagle Creek, which flows into the Powder River and flows southeast into the Snake River near Brownlee Reservoir. The Burnt River drains the Burnt River Valley and flows southeast into the Snake River near Huntington.

Most of the valley bottom land is moderately well drained to poorly drained and has a high water table in the spring and early summer. A few areas of Baker Valley and the Lower Powder Valley have salt-affected soils. The accumulations of salt are directly related to the low rainfall in the area, the high rate of evaporation, and the high water table.

Baker County is bordered on the west by the Elkhorn Ridge of the Blue Mountains, on the north by the Wallowa Mountains, and on the east by the Snake River Canyon. The higher areas are steep, rugged, and mainly forested. Other mountainous areas in the county include Big Lookout Mountain, Little Lookout Mountain, Dooley Mountain, and Pedro Mountain, all south of Baker City.

The geology of the mountains is variable. The Elkhorn Ridge west of Baker City is mainly argillite and other metamorphics, and northwest of Baker City is mainly quartz diorite and related granitic rocks. Dooley Mountain is largely volcanic breccias and rhyolite. Big Lookout Mountain is granite, basalt, and limestone.

In the eastern part of the survey area, which is dominantly gently sloping to steep rangeland, the rocks are mainly basalt, argillite, greenstone, and granite. The rock types in the southern part of the survey area are mainly basalt, greenstone, limestone, schist, and lacustrine sediments.

Materials from the rocks have been transported by streams and have contributed to the soil material in the valleys.

Climate

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

The Rocky Mountains partly shield the survey area from strong arctic winds, so winters there are cold but generally not severe. In summer, the mountains partly block the winds off the Pacific Ocean and the days are hot, but the nights are fairly cool. Precipitation in summer is scant in all but the mountainous areas, but during the cooler parts of the year precipitation is adequate for irrigated small grains and for rangeland. The snowpack at high elevations supplies irrigation water for intensive agriculture in parts of the lowlands.

The climate tables provide information recorded at Baker, Halfway, and Huntington in the period 1951-81. Table 1 gives data on temperature and precipitation. 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 Baker, Halfway, and Huntington is 30, 27, and 32 degrees F, respectively. The average daily minimum temperature is 21 degrees at Baker, 17 degrees at Halfway, and 24 degrees at Huntington. The lowest temperature on record, -33 degrees, occurred at Halfway on January 22, 1962. In summer, the average temperature is 75 degrees at Huntington and 65 degrees at Baker and Halfway. The average daily maximum temperature in summer is 82 degrees at Baker, 85 degrees at Halfway, and 91 degrees at Huntington. The highest recorded temperature, which occurred at Huntington on July 19, 1960, is 113 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 12 inches at Baker, 22 inches at Halfway, and 13 inches at Huntington. Of this, 50 percent at Baker and 30 percent at Halfway and Huntington usually fall in April through September, the growing season for most crops. The heaviest 1-day rainfall during the period of record was 7 inches at Baker on March 2, 1957. Thunderstorms occur on about 15 days each year, and most occur in summer.

The average seasonal snowfall is 26 inches at Baker, 62 inches at Halfway, and 25 inches at Huntington. The greatest snow depth at any one time during the period of record was 30 inches at Baker, 48 inches at Halfway, and 21 inches at Huntington. On an annual average of 15 days at Baker, 52 days at Halfway, and 71 days at Huntington, at least 1 inch of snow is on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 50 percent. Humidity is higher at night, and the average at dawn is about 70 percent. The sun shines 85 percent of the time in summer and 45 percent in winter. The prevailing wind is from the southeast. Average windspeed is highest, 10 miles per hour, in spring.

How This Survey Was Made

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

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

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

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

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

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

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

General Soil Map Units

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

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

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

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

Map Unit Descriptions

Warm, Dry, Nearly Level Soils on Flood Plains and Low Terraces

1. Wingville-Baldock-Balm

Deep, poorly drained and somewhat poorly drained silt loams and loams that formed in mixed alluvium

This map unit consists of soils on broad flood plains and low alluvial terraces adjacent to the Burnt and Powder Rivers, Eagle Creek, and the Baldock Slough. Slope is 0 to 3 percent. The native vegetation is mainly sedges, rushes, grasses, and shrubs. Elevation is 2,000 to 3,600 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 45 to 51 degrees F, and the average frost-free period is 110 to 140 days.

This unit makes up about 3 percent of the survey area. It is about 50 percent Wingville soils, 25 percent Baldock soils, and 10 percent Balm soils. The rest is soils of minor extent.

Wingville soils are subject to rare flooding and are somewhat poorly drained. They have a surface layer of black and very dark brown silt loam and a substratum of light brownish gray silt loam and olive gray, stratified alluvium. These soils are on low, broad alluvial terraces.

Baldock soils are occasionally flooded and poorly drained. They have a surface layer of very dark grayish brown silt loam and a substratum of dark gray silt loam. These soils are in old meander channels and depressional areas on flood plains.

Balm soils are subject to rare flooding and are somewhat poorly drained. They have a surface layer of very dark brown loam and silt loam and a substratum of olive gray, stratified alluvium. These soils are on flood plains adjacent to rivers and streams.

Of minor extent in this unit are the poorly drained Boyce and Wingdale soils. Boyce soils are in depressions adjacent to the Balm soils, and Wingdale soils are in depressions adjacent to the Wingville soils.

The soils in this unit are used mainly for irrigated hay and pasture. The unit also provides habitat for many kinds of wildlife. In the areas used for hay and pasture, the main limitation is a high water table. The soils are poorly suited to homesite development because of the high water table and the hazard of flooding.

2. Baker-Powval

Deep and moderately deep, well drained silt loams that formed in alluvium

This map unit consists of soils on low alluvial terraces, mainly in Baker and Eagle Valleys. Slope is 0 to 7 percent. The native vegetation is mainly grasses and shrubs. Elevation is 2,000 to 3,500 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free season is 110 to 140 days.

This unit makes up about 4 percent of the survey area. It is about 50 percent Baker soils and 30 percent Powval soils. The rest is soils of minor extent.

Baker soils are well drained and moderately deep. They have a surface layer of very dark grayish brown silt loam and a subsoil of brown loam over a duripan at a depth of 20 to 40 inches.

Powval soils are well drained and deep. They have a surface layer of very dark grayish brown silt loam, a subsoil of dark grayish brown silt loam, and a substratum of dark gray silt loam.

Of minor extent in this unit are the moderately well drained and well drained Cumulic Haploxerolls and the well drained Jett soils. These soils are on low terraces adjacent to streams.

The soils in this unit are used mainly for hay and pasture, crop production, and homesite development. The unit also provides habitat for many kinds of wildlife. In the areas used for hay and pasture or for crop production, the main limitation is the limited rooting depth caused by a cemented duripan in the Baker soils. In the areas used for homesite development, the main limitations are the depth to a cemented duripan and a potential for frost action in the Baker soils and wetness and the potential for frost action in the Powval soils.

3. Haines-Umapine-Stanflow

Deep and moderately deep, moderately well drained, somewhat poorly drained, and poorly drained, salt-affected silt loams that formed in mixed alluvium

This map unit consists of salt-affected soils on low alluvial terraces and flood plains, mainly in Baker Valley. A few small areas are in the Lower Powder River Valley and Eagle Valley. Slope is 0 to 2 percent. The native vegetation is mainly salt-tolerant grasses and shrubs. Elevation is 2,000 to 3,500 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 110 to 140 days.

This unit makes up about 2 percent of the survey area. It is about 40 percent Haines soils, 25 percent Umapine soils, and 15 percent Stanflow soils. The rest is soils of minor extent.

Haines soils are deep and poorly drained. They have a surface layer and subsoil of dark grayish brown silt loam and a substratum of grayish brown silt loam. These soils are subject to rare flooding in spring. They are on flood plains.

Umapine soils are deep and somewhat poorly drained. They have a surface layer of light gray silt loam and a substratum of very pale brown silt loam. These soils are subject to rare flooding in spring. They are on low terraces.

Stanflow soils are moderately deep to a weakly cemented hardpan and are moderately well drained. They have a surface layer and subsoil of dark grayish brown silt loam. Depth to the hardpan is 20 to 40 inches. These soils are on low terraces.

Of minor extent in this unit are the deep, poorly drained Baldock and Burkemont soils. These soils are subject to rare flooding in spring. They are on low terraces.

The soils in this unit are used mainly for irrigated hay and pasture. The unit also provides habitat for many kinds of wildlife. In the areas used for hay and pasture, the main limitations are a high water table and a high content of sodium. This unit is poorly suited to crop production because of the high content of sodium in the upper soil layers (fig. 2). The unit also is poorly suited to homesite development because of the high water table and the hazard of flooding.

Cool, Moist, Nearly Level Soils on Flood Plains and Low Terraces

4. Langrell-Hershal-Catherine

Deep, well drained, somewhat poorly drained, and poorly drained silt loams, gravelly loams, and very cobbly loams that formed in mixed alluvium

This map unit consists of soils on broad flood plains and low outwash terraces in areas in Pine Valley near Halfway. The soils in this unit are subject to rare flooding in spring. Slope is 0 to 3 percent. The native vegetation is mainly grasses, shrubs, and scattered conifers and hardwoods. Elevation is 2,300 to 3,400 feet. The average annual precipitation is 18 to 22 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 110 to 130 days.

This unit makes up about 1 percent of the survey area. It is about 25 percent Langrell soils, 20 percent Hershal soils, and 20 percent Catherine soils. The rest is soils of minor extent.

Langrell soils are well drained. They have a surface layer of very dark grayish brown gravelly and very cobbly loam, a subsoil of dark brown gravelly and extremely cobbly loam, and a substratum of dark brown stony sandy loam. These soils are on low, broad outwash terraces.

Hershal soils are poorly drained. They have a surface layer of very dark brown silt loam and a substratum of stratified, sandy and gravelly material. These soils are on flood plains.

Catherine soils are somewhat poorly drained. They have a surface layer of black silt loam and a substratum of very dark grayish brown silt loam and fine sandy

Figure 2.—Reclamation of alkali soil in the Haines-Umapine-Stanflow unit.

loam. These soils are on flood plains.

Of minor extent in this unit are the well drained Applegate, Halfway, and La Grande soils. These soils are on low terraces and foot slopes adjacent to the flood plains in Pine Valley.

The soils in this unit are used mainly for irrigated hay and pasture (fig. 3). Some areas of the Catherine soils are used for small grain. The Langrell soils are used for limited homesite development. The unit also provides habitat for many kinds of wildlife. In the areas used for hay and pasture, the main limitations are a low available water capacity in the Langrell soils and a high water table in the Hershal and Catherine soils. If the Catherine soils are used for small grain, the main limitation is the high water table. If the Langrell soils are used for homesite development, the main management concerns are the hazard of flooding and a moderate potential for frost action.

5. Damore-Silvies-Sumpley

Deep, somewhat poorly drained and poorly drained silt loams that formed in alluvium

This map unit consists of soils on flood plains at high elevations, mainly in Sumpter Valley and near Unity. Slope is 0 to 3 percent. The native vegetation is mainly grasses and sedges. Elevation is 3,700 to 5,000 feet. The average annual precipitation is 12 to 25 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 50 to 90 days.

This unit makes up about 1 percent of the survey area. It is about 30 percent Damore soils, 25 percent Silvies soils, and 20 percent Sumpley soils. The rest is soils of minor extent.

Damore soils are somewhat poorly drained. They have a surface layer of very dark brown silt loam, a subsoil of dark yellowish brown silty clay loam and brown silty clay, and a substratum of olive brown

Figure 3.—Irrigated hay and pasture in the Langrell-Hershall-Catherine unit.

gravelly clay. These soils are occasionally flooded in spring and early summer.

Silvies soils are poorly drained. They have a surface layer of black silt loam and a substratum of very dark grayish brown silty clay and clay. These soils are occasionally flooded in spring and early summer.

Sumpley soils are somewhat poorly drained. They have a surface layer of very dark gray silt loam, a subsoil of dark grayish brown loam, and a substratum of stratified, gravelly alluvium. These soils are occasionally flooded in spring and early summer.

Of minor extent in this unit are the poorly drained Stovepipe soils and Typic Xerorthents (areas of mine tailings). Stovepipe soils are mapped in complex with the Sumpley soils. Typic Xerorthents are in areas adjacent to the Sumpley and Stovepipe soils in Sumpter Valley.

The soils in this unit are used mainly for hay and pasture. The unit also provides habitat for many kinds of wildlife. In the areas used for hay and pasture, the main limitation is a high water table in spring. The soils are poorly suited to homesite development because of the high water table and the hazard of flooding.

Warm, Dry, Gently Sloping to Steep Soils on Terraces, Fans, and Hills

6. Hyall-Barnard-Simas

Moderately deep and deep, well drained silt loams, cobbly silt loams, gravelly silty clay loams, and very gravelly clay loams that formed in mixed alluvium

This map unit consists of soils on old terraces and terrace side slopes adjacent to Eagle Valley near Richland. Slope is 2 to 60 percent. The native vegetation is mainly bunchgrasses and shrubs. Elevation is 2,300 to 3,500 feet. The average annual precipitation is 9 to 12 inches, the average annual air

temperature is 45 to 51 degrees F, and the average frost-free period is 100 to 140 days.

This unit makes up about 2 percent of the survey area. It is about 30 percent Hyall soils, 25 percent Barnard soils, and 20 percent Simas soils. The rest is soils of minor extent.

Hyall soils are deep over bedrock and moderately deep to consolidated gravelly alluvium. They have a surface layer of very dark brown very gravelly clay loam, a subsoil of dark brown very gravelly and extremely gravelly clay, and a substratum of gravelly consolidated alluvium. These soils are on south- and west-facing side slopes on terraces. Slope is 12 to 60 percent.

Barnard soils are moderately deep to a duripan. They have a surface layer of very dark grayish brown silt loam and a subsoil of brown silty clay over an indurated duripan. In a few areas they have a cobbly surface layer. These soils are on terraces. Slope is 2 to 20 percent.

Simas soils are deep. They have a surface layer of dark grayish brown gravelly silty clay loam and a subsoil of dark brown clay. These soils are on north- and east-facing side slopes on terraces. Slope is 12 to 60 percent.

Of minor extent in this unit are Hibbard and Rockly soils and Badland. Hibbard and Rockly soils are at the higher areas on the top of terraces. Badland is mapped in complex with the Hyall soils on steep, south-facing slopes.

The soils in this unit are used mainly for livestock grazing. Some areas of the Barnard soils are used for irrigated hay and pasture. The unit also provides habitat for many kinds of wildlife. In the areas used for livestock grazing, the main limitation is the slope of the Hyall and Simas soils. If the Barnard soils are used for hay and pasture, the main limitation is the depth to an indurated duripan and the slope. If the Barnard soils are used for homesite development, the main limitations are the depth to an indurated duripan, slow permeability, and the slope. The Hyall and Simas soils are poorly suited to homesite development because of the slope.

7. Virtue-Poall-Encina

Deep and moderately deep, well drained silt loams, gravelly silt loams, and very fine sandy loams that formed in lacustrine sediments

This map unit consists of soils on terraces, fans, and hills, mainly in the Virtue Flat Area and between Durkee and Huntington in the southern part of the survey area. Slope is 2 to 50 percent. The native vegetation is mainly bunchgrasses, forbs, and shrubs. Elevation is 2,200 to 4,000 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 45 to 52 degrees F, and the average frost-free period is 110 to 140 days.

This unit makes up about 10 percent of the survey area. It is about 40 percent Virtue soils, 15 percent Poall soils, and 15 percent Encina soils. The rest is soils of minor extent.

Virtue soils are moderately deep to a duripan. They have a surface layer mainly of dark brown silt loam and a subsoil of dark yellowish brown silty clay loam and loam over an indurated duripan. In some areas the surface layer is gravelly silt loam. These soils are on terraces and fans. Slope is 2 to 12 percent.

Poall soils are deep. They have a surface layer of dark brown very fine sandy loam and a subsoil of dark brown clay over dark yellowish brown very fine sandy loam. These soils are on hills. Slope is 2 to 40 percent.

Encina soils are deep. They have a surface layer of very dark grayish brown gravelly silt loam and a subsoil of dark brown clay over yellowish brown silty clay loam and silt loam. These soils are on terraces. Slope is 2 to 50 percent.

Of minor extent in this unit are the well drained Legler, Nagle, and Oxman soils, Xeric Torriorthents, and Aridic Haploxerolls. Legler soils are deep. They are in incised areas adjacent to the Virtue soils. Nagle soils are deep. They are on north-facing slopes adjacent to the Encina soils. Oxman soils are moderately deep. They are on dissected fan terraces. Xeric Torriorthents are very shallow to deep. They are on terrace escarpments. They are mapped in complex with the Poall and Oxman soils. Aridic Haploxerolls are deep. They are in alluvial deposits on fans.

The soils in this unit are used mainly for livestock grazing. The Virtue and Encina soils are used for limited hay and pasture production. The unit also provides habitat for many kinds of wildlife. In the areas used for livestock grazing, there are no major limitations. If the Virtue and Encina soils are used for hay and pasture, the main limitations are the depth to an indurated duripan in the Virtue soils and the slope of both soils.

Cool, Moist, Nearly Level to Steep Soils on Terraces, Fans, and Hills

8. Marack-Campcreek-Skullgulch

Deep, well drained silt loams, very gravelly loams, silty clay loams, gravelly silty clay loams, and very gravelly silty clay loams that formed in mixed alluvium and lacustrine sediments

This map unit consists of soils on old terraces and terrace side slopes. These soils are mainly in the southwest part of the survey area, near Unity. Slope is 2 to 60 percent. The native vegetation is mainly bunchgrasses and shrubs. Elevation is 3,800 to 4,700 feet. The average annual precipitation is 9 to 16 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 60 to 90 days.

This unit makes up about 6 percent of the survey area. It is 40 percent Marack soils, 20 percent Campcreek soils, and 15 percent Skullgulch soils. The rest is soils of minor extent.

Marack soils have a surface layer of very dark grayish brown gravelly silty clay loam and a subsoil of brown clay over yellowish brown very gravelly loam. The depth to lacustrine sediments is 40 to 60 inches. In some areas the surface layer is very gravelly silty clay loam or silt loam. These soils formed in lacustrine sediments on low terraces. Slope is 2 to 40 percent. The average annual precipitation is 9 to 12 inches.

Campcreek soils have a surface layer of very dark grayish brown very gravelly loam and a subsoil of dark yellowish brown and dark brown clay. They are on south- and west-facing side slopes on terraces. They formed in old alluvium. Slope is 12 to 60 percent. The average annual precipitation is 12 to 16 inches.

Skullgulch soils have a surface layer of very dark grayish brown silt loam and a subsoil of dark yellowish brown and dark brown clay. In some areas the surface layer is silty clay loam. These soils are on north- and east-facing side slopes on terraces. They formed in old alluvium. Slope is 7 to 60 percent. The average annual precipitation is 12 to 16 inches.

Of minor extent in this unit are the well drained Burntriver, Rastus, and Wahstal soils and a few small areas of Badland. Burntriver soils are deep. They are adjacent to the Marack soils on low terraces. Rastus soils are moderately deep to a duripan. They are on terrace tops above the Campcreek and Skullgulch soils. Wahstal soils are shallow to a duripan and are very cobbly. They are on terrace tops adjacent to the Rastus soils.

The soils in this unit are used mainly for livestock grazing. The unit also provides habitat for many kinds of wildlife. In the areas used for livestock grazing, the main limitation is the slope of the Campcreek and Skullgulch soils.

9. McEwen

Deep, well drained silt loams that formed in mixed alluvium

This map unit consists of soils on old terraces and terrace side slopes, mainly in the western part of the survey area, near Sumpter Valley. Slope is 2 to 20 percent. The native vegetation is mainly coniferous trees. Elevation is 3,900 to 4,400 feet. The average annual precipitation is 16 to 24 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 50 to 90 days.

This unit makes up about 1 percent of the survey area. It is about 80 percent McEwen soils. The rest is soils of minor extent.

McEwen soils have a surface layer mainly of dark brown silt loam, a subsoil of dark reddish brown clay loam, and a substratum of dark reddish brown extremely gravelly loam. In some areas the surface layer is gravelly silt loam.

Of minor extent in this unit are Highhorn, Huntrock, and Webfoot soils. Highhorn and Huntrock are on mountain slopes. Highhorn soils are deep and well drained, and Huntrock soils are moderately deep and well drained. Webfoot soils are deep and somewhat poorly drained. They are in depressions adjacent to the McEwen soils.

The soils in this unit are used mainly for timber production. They also are used for limited hay and pasture production, homesite development, and habitat for many kinds of wildlife. In the areas used for timber production, the main hazards are soil compaction and displacement. In the areas used for hay and pasture, the main limitation is the slope. If the unit is used for homesite development, the main limitations are low soil strength, the slope, and moderately slow permeability.

10. Ladd-Goodrich

Deep, well drained loams and gravelly loams that formed in alluvium and colluvium

This map unit consists of soils on alluvial fans and foot slopes, mainly on the west side of Baker Valley. Slope is 0 to 12 percent. The native vegetation is mainly bunchgrasses, shrubs, and a few scattered pine trees. Elevation is 3,400 to 4,000 feet. The average annual precipitation is 12 to 16 inches, the average annual air temperature is 45 to 50 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 40 percent Ladd soils and 35 percent Goodrich soils. The rest is soils of minor extent.

Ladd soils have a surface layer of very dark brown loam and a subsoil of dark brown loam over clay loam. The substratum is brown loam and clay loam. These soils formed in alluvium and colluvium on foot slopes and fans. Slope is 2 to 12 percent.

Goodrich soils have a surface layer of very dark grayish brown gravelly loam and a substratum of dark brown gravelly loam over very gravelly loam. They formed in mixed alluvium on fans. Slope is 0 to 7 percent.

Of minor extent in this unit are Benderly and Hibbard soils. Benderly soils are deep and somewhat excessively drained. They have a surface layer of gravelly fine sandy loam. They are mapped in complex with the Goodrich soils. Hibbard soils are moderately deep to a duripan. They are on old terraces adjacent to the Goodrich and Ladd soils.

The soils in this unit are used mainly for irrigated hay and pasture or for small grain. Some areas are used for limited homesite development or livestock grazing. The unit also provides habitat for many kinds of wildlife. In the areas used for hay and pasture or for small grain, the main management concerns are the droughtiness caused by a low available water capacity in the Goodrich soils and the hazard of seepage. If the unit is used for homesite development, the main limitations are the shrink-swell potential, low soil strength, moderately slow permeability, and potential for frost action in the Ladd soils and the potential for frost action in the Goodrich soils.

Warm, Dry, Gently Sloping to Very Steep Soils on Hills

11. Ruckles-Ruclick-Lookout

Shallow and moderately deep, well drained silt loams, very cobbly silt loams, and very stony clay loams that formed in colluvium derived from basalt

This map unit consists of soils in the central and southern parts of the survey area. Slope is 2 to 70 percent. The native vegetation is mainly bunchgrasses and shrubs. Elevation is 2,000 to 3,800 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 140 days.

This unit makes up about 11 percent of the survey area. It is about 40 percent Ruckles soils, 40 percent Ruclick soils, and 10 percent Lookout soils. The rest is soils of minor extent.

Ruckles soils are shallow. They have a surface layer of very dark grayish brown very stony clay loam and a subsoil of dark brown very stony clay. These soils are on south- and west-facing slopes on hills. Slope is 2 to 70 percent.

Ruclick soils are moderately deep. They have a surface layer of very dark grayish brown very cobbly silt loam and a subsoil of dark brown very cobbly and extremely cobbly clay. These soils are on all aspects of hills. Slope is 2 to 70 percent.

Lookout soils are moderately deep to a duripan. They have a surface layer mainly of very dark grayish brown very cobbly silt loam and a subsoil of dark yellowish brown clay over a duripan. In some areas the surface layer is silt loam. These soils are on hilltops and benches. Slope is 2 to 12 percent.

Of minor extent in this unit are Bakeoven, Lickskillet, Redcliff, and Snellby soils. Bakeoven soils are very shallow. They are mapped in complex with the Ruckles soils in many gently sloping areas. Lickskillet soils are shallow and are very gravelly or very cobbly. They are on steep, south-facing slopes. Redcliff soils are moderately deep and gravelly. They are on north-facing slopes adjacent to the Lickskillet soils. Snellby soils are moderately deep and stony. They are on steep, north-facing slopes near the Ruckles and Ruclick soils at the higher elevations.

The soils in this unit are used mainly for livestock grazing. The unit also provides habitat for many kinds of wildlife. In the areas used for livestock grazing, the main limitations are the very cobbly or very stony surface layer and the slope of the Ruckles and Rucklick soils.

12. North Powder-Brownscombe

Moderately deep, well drained silt loams and loams that formed in colluvium and residuum derived from granitic rocks

This map unit consists of soils that are mainly in the northern part of the survey area. Slope is 2 to 60 percent. The native vegetation is mainly bunchgrasses, forbs, and shrubs. Elevation is 2,400 to 3,800 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 110 to 130 days.

This unit makes up about 2 percent of the survey area. It is about 40 percent North Powder soils and 30 percent Brownscombe soils. The rest is soils of minor extent.

North Powder soils have a surface layer of dark grayish brown loam and a subsoil of dark brown clay loam and loam. These soils are on all aspects of hills. Slope is 2 to 35 percent.

Brownscombe soils have a surface layer of very dark grayish brown silt loam and a subsoil of dark yellowish brown sandy clay loam and sandy clay. These soils are on all aspects of hills. Slope is 2 to 60 percent.

Of minor extent in this unit are Glasgow and Greenscombe soils. Glasgow soils are moderately deep over volcanic tuff bedrock. They are adjacent to the Brownscombe soils and have a slope of 2 to 7 percent. Greenscombe soils are moderately deep. They are adjacent to the Brownscombe soils but are at higher elevations.

The soils in this unit are used mainly for livestock grazing. The North Powder soils are used for limited irrigated hay and pasture or for small grain. The unit also provides habitat for many kinds of wildlife. In the areas used for livestock grazing, the main limitation is the slope of the Brownscombe soils. If the North Powder soils are used for hay and pasture or for small grain, the main limitations are the slope and the depth to bedrock.

13. Snaker-Lovline-Darkcanyon

Shallow and moderately deep, well drained channery loams and extremely channery loams that formed in colluvium and residuum derived from schist

This map unit consists of soils that are mainly in the southern part of the survey area. Slope is 2 to 80 percent. The native vegetation is mainly bunchgrasses and shrubs. Elevation is 2,000 to 4,000 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 45 to 51 degrees F, and the average frost-free period is 100 to 140 days.

This unit makes up about 3 percent of the survey area. It is about 40 percent Snaker soils, 35 percent Lovline soils, and 20 percent Darkcanyon soils. The rest is soils of minor extent.

Snaker soils are shallow. They have a surface layer of brown channery loam and a substratum of brown very channery loam. These soils are on south-facing slopes. They commonly are mapped in complex with Darkcanyon soils. Slope is 30 to 80 percent.

Lovline soils are moderately deep. They have a surface layer of very dark grayish brown channery loam and a subsoil of dark yellowish brown channery loam. These soils are mainly on north-facing slopes. Slope is 2 to 70 percent.

Darkcanyon soils are moderately deep. They have a surface layer of grayish brown extremely channery loam and a subsoil of dark grayish brown extremely channery clay loam. These soils are on south-facing slopes. They commonly are mapped in complex with the shallow Snaker soils. Slope is 30 to 80 percent.

Of minor extent in this unit are Xeric Torriorthents. These soils are shallow to deep and are well drained or somewhat excessively drained. They are on steep, south-facing slopes. They are mapped in complex with the Darkcanyon and Snaker soils.

The soils in this unit are used mainly for livestock grazing. The unit also provides habitat for many kinds of wildlife. In the areas used for livestock grazing, the main limitation is the slope.

Warm, Moist, Gently Sloping to Very Steep Soils on Hills

14. Keating-Ridley

Moderately deep and deep, well drained silt loams that formed in colluvium derived from greenstone

This map unit consists of soils that are mainly in the northern pert of the survey area. Slope is 2 to 35 percent. The native vegetation is mainly bunchgrasses, forbs, and shrubs. Elevation is 3,000 to 3,800 feet. The average annual precipitation is 12 to 16 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 130 days.

This unit makes up about 2 percent of the survey area. It is about 50 percent Keating soils and 25 percent Ridley soils. The rest is soils of minor extent.

Keating soils are moderately deep. They have a surface layer of very dark brown silt loam and a subsoil of dark brown clay loam over clay. These soils are on all aspects of hills. Slope is 2 to 35 percent.

Ridley soils are deep. They have a surface layer of very dark brown silt loam and a subsoil of dark brown silty clay loam over clay. These soils are mapped in complex with the Keating soils. Slope is 2 to 12 percent.

Of minor extent in this unit are Clovercreek and Pritchard soils. Clovercreek soils are shallow. They are mapped in complex with the Keating soils. Pritchard soils are deep and formed in colluvium derived from gabbro.

The soils in this unit are used mainly for livestock grazing. A few areas are used for irrigated hay and pasture or for small grain. The unit also provides habitat for many kinds of wildlife. In the areas used for livestock grazing, there are no major limitations. In the areas used for hay and pasture or for small grain, the main limitations are the slope and the limited rooting depth of the Keating soils.

15. Gwinly-Immig-Snell

Shallow and moderately deep, well drained very cobbly silt loams and silt loams that formed in colluvium derived from basalt

This map unit consists of soils in the northeastern part of the survey area. Slope is 2 to 80 percent. The native vegetation is mainly bunchgrasses and shrubs. Elevation is 2,000 to 5,700 feet. The average annual precipitation is 14 to 20 inches, the average annual air temperature is 40 to 50 degrees F, and the average frost-free period is 60 to 120 days.

This unit makes up about 8 percent of the survey area. It is about 35 percent Gwinly soils, 20 percent

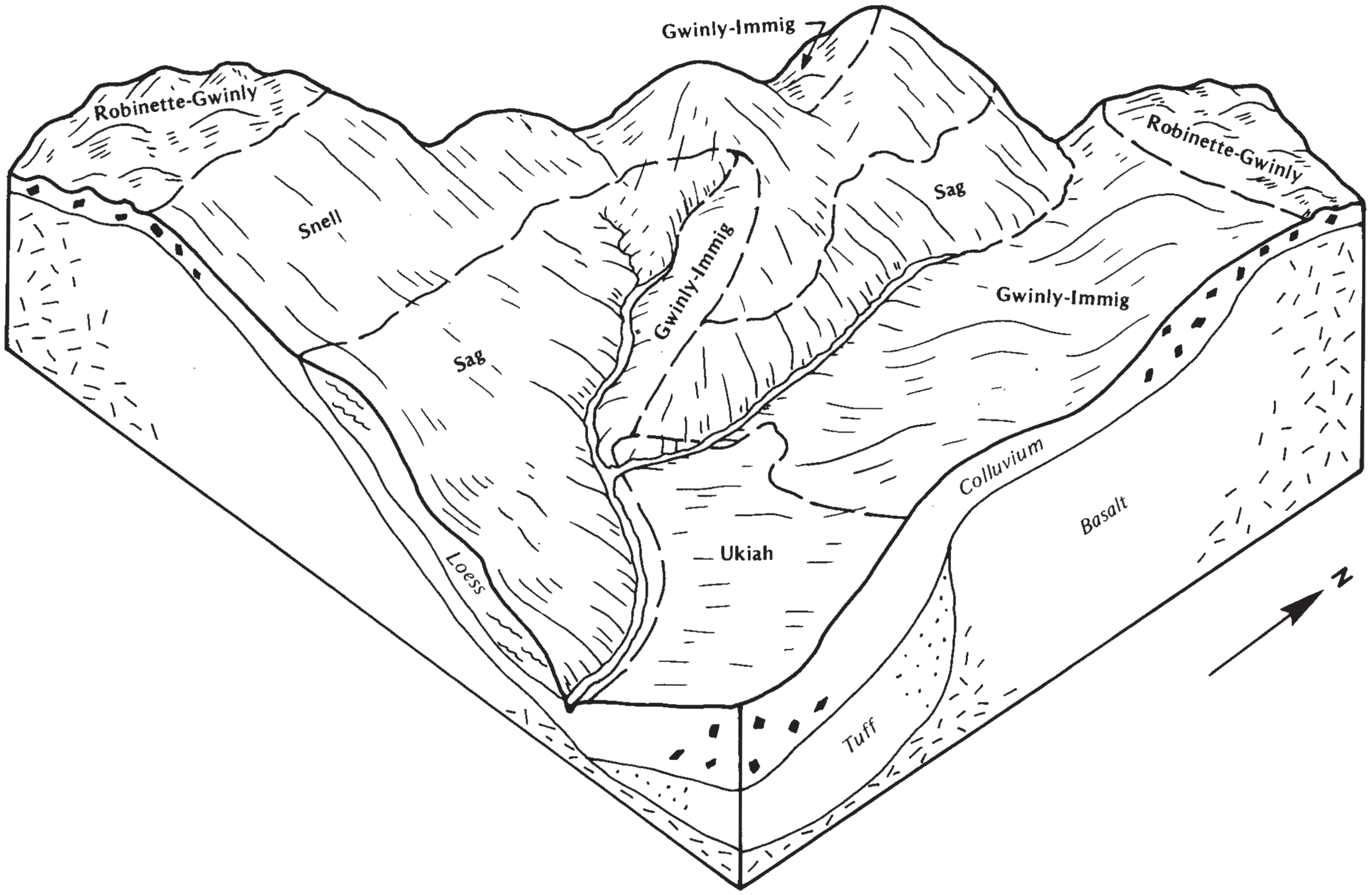

Figure 4.—Typical pattern of soils and parent material in the Gwinly-Immig-Snell unit.

Immig soils, and 15 percent Snell soils (fig. 4). The rest is soils of minor extent.

Gwinly soils are shallow. They have a surface layer of very dark brown very cobbly silt loam and a subsoil of dark brown extremely cobbly clay. These soils are on south- and west-facing slopes. They are mapped in complex with the Immig soils. Slope is 12 to 70 percent.

Immig soils are moderately deep. They have a surface layer of very dark grayish brown very cobbly silt loam and a subsoil of dark brown very cobbly and extremely cobbly clay. In some areas the surface layer is silt loam. These soils are on south- and west-facing slopes. They are mapped in complex with the Gwinly soils. Slope is 2 to 70 percent.

Snell soils are moderately deep. They have a surface layer of very dark brown very cobbly silt loam and a subsoil of dark brown extremely cobbly clay. These soils are mainly on north-facing slopes in association with the Gwinly and Immig soils. Slope is 12 to 80 percent.

Of minor extent in this unit are Copperfield, Robinette, Rockly, Sag, and Ukiah soils. Copperfield soils are deep. They are on steep, north-facing slopes at low elevations. Robinette soils are deep. They are in gently sloping areas known locally as biscuit scab. They are mapped in complex with the Gwinly soils. Rockly soils are very shallow. They are mapped in complex with the Gwinly soils. Sag soils are deep. They are on steep, north-facing slopes. They are mapped in complex with the Snell soils. Ukiah soils are moderately deep and clayey. They are mainly in gently sloping areas.

The soils in this unit are used mainly for livestock grazing. In some areas the Immig soils that have a surface layer of silt loam are used for hay and pasture. The unit also provides habitat for many kinds of wildlife. In the areas used for livestock grazing, the main limitations are the very cobbly surface layer and the slope. If the Immig soils are used for hay and pasture, the main limitations are the slope and the droughtiness caused by a low available water capacity.

Cool, Moist, Gently Sloping to Very Steep Soils on Hills and Mountains

16. Taterpa-Brownlee

Deep, well drained loams that formed in colluvium and residuum derived from granitic rocks

This map unit consists of soils that are mainly in the northern part of the survey area, near Sparta, and in the southern part of the survey area, near Pedro Mountain. Slope is 2 to 60 percent. The native vegetation is mainly bunchgrasses and shrubs. Elevation is 3,600 to 6,200 feet. The average annual precititation is about 16 to 20 inches, the average annual air temperature is 40 to 49 degrees F, and the average frost-free period is 60 to 130 days.

This unit makes up about 3 percent of the survey area. It is about 40 percent Taterpa soils and 25 percent Brownlee soils. The rest is soils of minor extent.

Taterpa soils have a surface layer of black loam and a subsoil of very dark grayish brown loam and gravelly loam. These soils are mainly on north-facing slopes on mountains at elevations of 4,000 to 6,200 feet. Slope is 12 to 60 percent.

Brownlee soils have a surface layer of very dark brown loam and a subsoil of dark brown clay loam and sandy clay loam. These soils are mainly on south-facing slopes on hills at elevations of 3,600 to 4,000 feet. Slope is 2 to 35 percent.

Of minor extent in this unit are Bouldrock and Shangland soils. Bouldrock soils are on south-facing slopes in association with the Taterpa soils at the higher elevations. Shangland soils are moderately deep. They are on south-facing slopes. They are mapped in complex with the Brownlee soils.

The soils in this unit are used mainly for livestock grazing. A few areas of the Brownlee soils are used for dryland hay or small grain. The unit also provides habitat for many kinds of wildlife. In the areas used for livestock grazing, the main limitation is slope of the Taterpa soils. If the Brownlee soils are used for hay or small grain, the main management concern is the hazard of erosion.

17. Durkee

Moderately deep, well drained gravelly silt loams that formed in colluvium derived from argillite

This map unit consists of soils on hills, mainly in the central part of the survey area. Slope is 2 to 60 percent. The native vegetation is mainly bunchgrasses and shrubs. Elevation is 3,600 to 5,000 feet. The average annual precipitation is 12 to 16 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 50 to 110 days.

This unit makes up about 5 percent of the survey area. It is about 80 percent Durkee soils and 20 percent soils of minor extent.

Durkee soils have a surface layer of very dark grayish brown gravelly silt loam and a subsoil of dark brown clay over clay loam. These soils are on all aspects of hills.

Of minor extent in this unit are Ateron soils and soils that are similar to the Durkee soils but are shallow. The minor soils are on ridgetops. Ateron soils are shallow, are very stony, and formed in colluvium derived from basalt or greenstone.

The soils in this unit are used mainly for livestock grazing. The unit also provides habitat for many kinds of wildlife. In the areas used for livestock grazing, the main limitation is the slope.

18. Ateron-Roostercomb

Shallow and moderately deep, well drained very stony loams and extremely gravelly clay loams that formed in colluvium derived from basalt and greenstone

This map unit consists of soils in the central and southern parts of the survey area. Slope is 2 to 60 percent. The native vegetation is mainly bunchgrasses and shrubs. Elevation is 3,600 to 5,700 feet. The average annual precipitation is 12 to 16 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 50 to 95 days.

This unit makes up about 14 percent of the survey area. It is about 55 percent Ateron soils and 25 percent Roostercomb soils. The rest is soils of minor extent.

Ateron soils are shallow. They have a surface layer of very dark gray very stony loam and a subsoil of dark brown very cobbly clay. In a few areas the surface layer is extremely gravelly clay loam. These soils are on all aspects. They commonly are mapped in complex with Snell soils, which are underlain by basalt, and with Roostercomb soils, which are underlain by greenstone.

Roostercomb soils are moderately deep. They have a surface layer of dark brown extremely gravelly clay loam and a subsoil of dark yellowish brown extremely gravelly and extremely cobbly clay. These soils formed in colluvium derived from greenstone. They are mapped in complex with the Ateron soils on south-facing slopes and with the Longbranch soils on north-facing slopes.

Of minor extent in this unit are Longbranch and Snell soils. Longbranch soils are deep over greenstone bedrock. They are mapped in complex with the Roostercomb soils on steep, north-facing slopes. Snell soils are moderately deep over basalt bedrock. They are mapped in complex with the Ateron soils on steep, north-facing slopes.

The soils in this unit are used mainly for livestock grazing. The unit also provides habitat for many kinds of wildlife. In the areas used for livestock grazing, the main limitations are the very stony or extremely gravelly surface layer and the slope.

19. Lostbasin-Sinker-Chambeam

Moderately deep and deep, well drained very channery loams that formed in colluvium derived from schist and graywacke

This map unit consists of soils that are mainly in the southern part of the survey area. Slope is 12 to 80 percent. The native vegetation is mainly bunchgrasses and shrubs. Elevation is 3,500 to 5,300 feet. The average annual precipitation is 12 to 16 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 60 to 100 days.

This unit makes up about 5 percent of the survey area. It is about 40 percent Lostbasin soils, 30 percent Sinker soils, and 20 percent Chambeam soils. The rest is soils of minor extent.

Lostbasin soils are moderately deep. They have a surface layer of dark grayish brown very channery loam and a subsoil of dark yellowish brown extremely channery clay loam. These soils are on south-facing slopes. Slope is 12 to 80 percent.

Sinker soils are moderately deep. They have a surface layer of very dark gray very channery loam and a subsoil of very dark grayish brown extremely channery clay loam. These soils are on north-facing slopes. They are mapped in complex with the Chambeam soils. Slope is 12 to 80 percent.

Chambeam soils are deep. They have a surface layer of very dark brown very channery loam and a subsoil of dark brown very channery loam. These soils are on steep, north-facing slopes. They are mapped in complex with the Sinker soils. Slope is 12 to 50 percent.

Of minor extent in this unit are the shallow to deep, well drained to somewhat excessively drained Xerorthents. These soils are on steep and very steep, south-facing slopes. They are mapped in complex with the Lostbasin soils.

The soils in this unit are used mainly for livestock grazing. The unit also provides habitat for many kinds of wildlife. In the areas used for livestock grazing, the main limitation is the slope.

Cool, Moist, Gently Sloping to Very Steep Soils on Mountains

20. McGarr-Top-Klicker

Moderately deep and deep, well drained stony silt loams, very stony loams, and silt loams that formed in colluvium derived from basalt

This map unit consists of soils that are mainly in the northeastern and western parts of the survey area. Slope is 12 to 65 percent. The native vegetation is mainly mixed conifers. Elevation is 3,300 to 6,000 feet. The average annual precipitation is 16 to 30 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 30 to 90 days.

This unit makes up about 4 percent of the survey area. It is about 30 percent McGarr soils, 25 percent Top soils, and 20 percent Klicker soils. The rest is soils of minor extent.

McGarr soils are moderately deep. They have a surface layer of very dark grayish brown very stony loam and a subsoil of dark brown gravelly loam and gravelly clay loam. These soils are on north-facing slopes. They are mapped in complex with Kahler and Top soils. Slope is 12 to 65 percent.

Top soils are deep. They have a surface layer of very dark grayish brown silt loam and a subsoil of dark reddish brown very cobbly silty clay. These soils are on steep and very steep, north- and east-facing slopes. They commonly are mapped in complex with the McGarr soils. Slope is 12 to 65 percent.

Klicker soils are moderately deep. They have a surface layer of very dark brown stony silt loam and a subsoil of dark reddish brown very cobbly silty clay loam. These soils are on south- and west-facing slopes. They commonly are mapped in complex with Anatone and Fivebit soils. Slope is 12 to 60 percent.

Of minor extent in this unit are Anatone, Emily, Fivebit, Hall Ranch, and Kahler soils. Anatone and Fivebit soils are shallow and extremely stony. They are in open areas. Emily soils are deep. They are at the lower elevations on north- and east-facing slopes. Hall Ranch soils are moderately deep. They are in gently sloping areas. Kahler soils are deep. They are on steep, north-facing slopes.

The soils in this unit are used mainly for timber production, for limited livestock grazing, and in watersheds. The unit also provides habitat for many kinds of wildlife. In the areas used for timber production, the main management concerns are the slope and the hazards of soil compaction and displacement. Other management concerns are the hazard of windthrow and the very stony or stony surface layer in areas of the McGarr and Klicker soils.

21. Dogtown-Kilmerque-Tolo

Moderately deep and deep, well drained gravelly loams, loams, very stony loams, and silt loams that formed in colluvium and residuum derived from granitic rocks and influenced by volcanic ash in the surface layer

This map unit consists of soils that are mainly along the west side of the survey area. Slope is 12 to 80 percent. The native vegetation is mainly mixed conifers. Elevation is 3,800 to 6,200 feet. The average annual precipitation is 17 to 35 inches, the average annual air temperature is 40 to 45 degrees, and the average frost-free period is 30 to 100 days.

This unit makes up about 3 percent of the survey area. It is about 30 percent Dogtown soils, 30 percent Kilmerque soils, and 20 percent Tolo soils. The rest is soils of minor extent.

Dogtown soils are deep. They have a surface layer of very dark grayish brown gravelly loam and a subsoil of dark brown very gravelly sandy loam. In some areas the surface layer is very stony loam. These soils are on north-facing slopes. Slope is 12 to 80 percent.

Kilmerque soils are moderately deep. They have a surface layer of very dark grayish brown loam and a subsoil of dark yellowish brown loam and sandy loam. These soils are on south-facing slopes. Slope is 12 to 80 percent.

Tolo soils are deep. They have a surface layer of very dark grayish brown silt loam and a subsoil of dark brown gravelly sandy loam. They have a thick mantle of volcanic ash. These soils are on foot slopes and benches. They are mapped in complex with the Dogtown soils. Slope is 12 to 35 percent.

Of minor extent in this unit are Bouldrock and Eaglecap soils. Bouldrock soils are moderately deep. They are on steep, south-facing slopes. They are mapped in complex with the Kilmerque soils. Eaglecap soils are deep. They are on very steep, north-facing slopes at high elevations.

The soils in this unit are used mainly for timber production, limited livestock grazing, and watershed. The unit also provides habitat for many kinds of wildlife. In the areas used for timber production, the main management concerns are the slope and the hazard of soil compaction. Also, the Dogtown soils are limited by the content of rock fragments, the Kilmerque soils are limited by a low available water capacity and the depth to bedrock, and the Tolo soils are limited by the hazard of soil displacement.

22. Crackler-Highhorn

Deep, well drained gravelly and very gravelly silt loams that formed in colluvium derived from argillite and influenced by volcanic ash in the surface layer

This map unit consists of soils that are mainly along the western side of the survey area. Slope is 2 to 75 percent. The native vegetation is mainly mixed conifers. Elevation is 3,800 to 7,200 feet. The average annual precipitation is 20 to 35 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 30 to 90 days.

This unit makes up about 2 percent of the survey area. It is about 40 percent Crackler soils and 30 percent Highhorn soils. The rest is soils of minor extent.

Crackler soils are deep. They have a surface layer of dark brown gravelly silt loam and a subsoil of brown very cobbly silty clay loam and extremely gravelly clay loam. These soils are on north-facing slopes. They are mapped in complex with Rouen soils. Slope is 2 to 50 percent.

Highhorn soils are deep. They have a surface layer of black very gravelly silt loam and a subsoil of brown very gravelly silty clay loam. These soils are on south-facing slopes. They are mapped in complex with Huntrock soils. Slope is 12 to 75 percent.

Of minor extent in this unit are Angelpeak, Huntrock, and Rouen soils. Angelpeak soils are deep. They are on steep and very steep, north-facing slopes at high elevations. Huntrock soils are on steep and very steep, south-facing slopes. Rouen soils are moderately deep. They are on north-facing slopes.

The soils in this unit are used mainly for timber production, limited livestock grazing, and watershed. The unit also provides habitat for many kinds of wildlife. In the areas used for timber production, the main limitations are the slope and the content of rock fragments.

23. Segundo-Inkler-Stices

Deep, well drained very gravelly and gravelly loams that formed in colluvium derived from rhyolite and andesite

This map unit consists of soils that are mainly in the central part of the survey area, around Dooley Mountain. Slope is 2 to 80 percent. The native vegetation is mainly mixed conifers. Elevation is 4,000 to 6,000 feet. The average annual precipitation is 16 to 35 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 30 to 90 days.

This unit makes up about 3 percent of the survey area. It is about 40 percent Segundo soils, 30 percent

Inkler soils, and 15 percent Stices soils. The rest is soils of minor extent.

Segundo soils have a surface layer of very dark brown very gravelly loam and a subsoil of brown very gravelly loam. These soils are on south-facing slopes. Slope is 2 to 75 percent.

Inkler soils have a surface layer of very dark brown very gravelly loam and a subsoil of brown very gravelly and extremely gravelly loam. These soils are on north-facing slopes. Slope is 2 to 70 percent.

Stices soils have a surface layer of dark brown gravelly loam that is high in content of volcanic ash and a subsoil of brown very gravelly loam. These soils are on north-facing slopes. Slope is 35 to 80 percent.

Of minor extent in this unit are Anatone, Baldridge, and Stavely soils. Anatone soils are shallow and stony. They are in open areas in the forest. Baldridge soils are deep. They are on south-facing slopes. They support grasses and shrubs. Stavely soils are deep and coarse textured. They are on forested south-facing slopes.

The soils in this unit are used mainly for timber production, limited livestock grazing, and watershed. The unit also provides habitat for many kinds of wildlife. In the areas used for timber production, the main management concerns are the slope, the content of rock fragments, and the hazards of soil compaction and displacement.

24. Piersonte-Sisley-Brannan

Deep and moderately deep, well drained channery silt loams and very channery loams that formed in colluvium and residuum derived from schist

This map unit consists of soils in the central part of the survey area, near Dooley Mountain and Lookout Mountain. Slope is 2 to 70 percent. The native vegetation is mainly mixed conifers. Elevation is 3,500 to 6,000 feet. The average annual precipitation is 16 to 35 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 30 to 90 days.

This unit makes up about 2 percent of the survey area. It is about 50 percent Piersonte soils, 30 percent Sisley soils, and 15 percent Brannan soils. The rest is soils of minor extent.

Piersonte soils are deep. They have a surface layer of black very channery loam and a subsoil of very dark gray extremely channery clay loam. These soils are on north-facing slopes. Slope is 35 to 70 percent.

Sisley soils are moderately deep. They have a surface layer of very dark grayish brown very channery loam and a subsoil of dark brown very channery loam. These soils are on south-facing slopes. Slope is 2 to 70 percent.

Brannan soils are deep. They have a surface layer of very dark grayish brown channery silt loam that is high in content of volcanic ash and a subsoil of brown channery silt loam and very channery sandy loam. These soils are on north-facing slopes. Slope is 2 to 70 percent.

Of minor extent in this unit are Lostbasin soils and Xerorthents. Lostbasin soils are moderately deep, are very channery, and formed in colluvium derived from schist or graywacke. Xerorthents are very shallow to deep, are extremely channery, and formed in colluvium and residuum derived from schist. They are in open areas on south-facing slopes adjacent to the Sisley soils.

The soils in this unit are used mainly for timber production, limited livestock grazing, and watershed. The unit also provides habitat for many kinds of wildlife. In the areas used for timber production, the main management concerns are the slope, the content of rock fragments, and the hazard of soil compaction. Also, the Sisley soils are limited by the depth to bedrock, and the Brannan soils are limited by the hazard of soil displacement.

25. Hankins-Boiler

Deep, well drained gravelly loams, very cobbly loams, and silt loams that formed in colluvium derived from tuffaceous sediments

This map unit consists of soils that are mainly in the southwestern part of the survey area, northwest of Unity. Slope is 2 to 60 percent. The native vegetation is mainly mixed conifers. Elevation is 4,000 to 5,000 feet. The average annual precipitation is 16 to 30 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 30 to 50 days.

This unit makes up about 2 percent of the survey area. It is about 35 percent Hankins soils and 30 percent Boiler soils. The rest is soils of minor extent.

Hankins soils have a surface layer of very dark gray silt loam and a subsoil of dark brown gravelly silty clay and clay. In some areas the surface layer is very cobbly loam. These soils are on north- and east-facing slopes. Slope is 2 to 35 percent.

Boiler soils have a surface layer of very dark grayish brown gravelly loam and a subsoil of brown extremely gravelly silty clay and clay. They are on north- and east-facing slopes. Slope is 35 to 60 percent.

Of minor extent in this unit are Derringer, Fivebit, Harlow, Hudspeth, and Morningstar soils. Derringer and Hudspeth soils are moderately deep. They are on steep, south-facing slopes. Harlow and Fivebit soils are shallow. They are on gently sloping to steep, south-facing slopes. Morningstar soils are deep. They are on steep, south-facing slopes. They are mapped in complex with Hudspeth soils.

The soils in this unit are used mainly for timber production, for limited livestock grazing, and for watersheds. The unit also provides habitat for many kinds of wildlife. In the areas used for timber production, the main limitations are the slope, the content of rock fragments, and the rooting depth in the Boiler soils. The Hankins soils are limited by the hazards of soil compaction and displacement.

Detailed Soil Map Units

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

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

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

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

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

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

Soils of one series can differ in texture of the surface layer or of the underlying layers. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. 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, Ateron very stony loam, 2 to 12 percent slopes, is one of several phases in the Ateron series.

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

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. Robinette-Gwinly complex, 2 to 12 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Campcreek-Skullgulch association, 12 to 35 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Sinker and Chambeam soils, 12 to 35 percent north slopes, is an undifferentiated group in this survey area.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Riverwash, 0 to 2 percent slopes, 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

1D—Anatone extremely stony loam, 12 to 35 percent south slopes. This shallow, well drained soil is on mountains. It formed in colluvium derived from rhyolite, andesite, and basalt. Areas are irregular in shape and are 20 to 200 acres in size. The native vegetation is mainly bunchgrasses, shrubs, and forbs. Elevation is 4,000 to 6,000 feet. The average annual precipitation is 16 to 20 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 60 to 90 days. I01Typically, the surface layer is black extremely stony loam about 8 inches thick. The subsoil is very dark brown extremely cobbly loam about 8 inches thick. The depth to bedrock is 10 to 20 inches.

Included in this unit are small areas of Baldridge, Klicker, and Segundo soils. Also included are small areas of soils that are similar to the Anatone soil but are less than 10 inches deep over bedrock and small areas of Rock outcrop. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate in the Anatone soil. Available water capacity is 1 to 2 inches. The effective rooting depth is 10 to 20 inches. Runoff is medium, and the hazard of water erosion is moderate or high.

This unit is used mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on this unit is dominated by bluebunch wheatgrass, squaw apple, and mountain big sagebrush.

Bluebunch wheatgrass is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 1,100 pounds per acre in favorable years and 500 pounds per acre in unfavorable years. Livestock access is limited by the extremely stony surface layer.

If the ecological condition of the site deteriorates through overgrazing, bluebunch wheatgrass loses vigor and decreases in extent. Sandberg bluegrass, mountain big sagebrush, and perennial forbs increase in extent. If deterioration continues, cheatgrass, soft brome, and other annual plants invade the site.

Mechanical treatment for brush control and range seeding is not practical because of the stoniness of the surface layer.

The Anatone soil is in the Mountain Shallow South 16-20pz range site.

1F—Anatone extremely stony loam, 50 to 75 percent south slopes. This shallow, well drained soil is on mountains. It formed in colluvium derived from rhyolite, andesite, and basalt. Areas are irregular in shape and are 20 to 200 acres in size. The native vegetation is mainly bunchgrasses, shrubs, and forbs. Elevation is 4,000 to 6,000 feet. The average annual precipitation is 16 to 20 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 60 to 90 days.

Typically, the surface layer is black extremely stony loam about 8 inches thick. The subsoil is very dark brown extremely cobbly loam about 8 inches thick. The depth to bedrock is 10 to 20 inches.

Included in this unit are small areas of Fivebit, Baldridge, Klicker, and Segundo soils. Also included are small areas of soils that are similar to the Anatone soil but are less than 10 inches deep over bedrock and small areas of Rock outcrop. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate in the Anatone soil.

Available water capacity is 1 to 2 inches. The effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is very high.

This unit is used mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on this unit is dominated by bluebunch wheatgrass, squaw apple, and mountain big sagebrush.

Bluebunch wheatgrass is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 1,100 pounds per acre in favorable years and 500 pounds per acre in unfavorable years. Livestock access is limited by the extremely stony surface layer.

If the condition of the site deteriorates through overgrazing, bluebunch wheatgrass loses vigor and decreases in extent. Sandberg bluegrass, mountain big sagebrush, and perennial forbs increase in extent. If deterioration continues, cheatgrass, soft brome, and other annual plants invade the site.

Mechanical treatment for brush control and range seeding is not practical because of the slope and the stoniness of the surface layer.

The Anatone soil is in the Mountain Shallow South 16-20pz range site.

2E—Anatone-Segundo complex, 35 to 50 percent south slopes. This map unit is on mountains. Areas are irregular in shape and are 40 to 400 acres in size. The native vegetation is mainly conifers, shrubs, bunchgrasses, and forbs. Elevation is 4,000 to 6,000 feet. The average annual precipitation is 16 to 30 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 60 to 90 days.

This unit is about 50 percent Anatone extremely stony loam and 35 percent Segundo very gravelly loam. The Anatone soil is used as rangeland, and the Segundo soil is used as woodland. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of Baldridge soils and Rock outcrop. Also included are small areas of Stavely and Klicker soils. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Anatone soil is shallow and well drained. It formed in colluvium derived from rhyolite, andesite, and basalt. Typically, the surface layer is black extremely stony loam about 8 inches thick. The subsoil is very dark brown extremely cobbly loam about 8 inches thick. The depth to bedrock is 10 to 20 inches.

Permeability is moderate in the Anatone soil. Available water capacity is 1 to 2 inches. The effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is high.

The Segundo soil is deep and well drained. It formed in colluvium derived from rhyolite and andesite. Typically, the surface layer is very dark brown very gravelly loam about 5 inches thick. The subsoil is brown very gravelly loam about 16 inches thick. The substratum to a depth of 60 inches or more is brown very gravelly sandy loam and multicolored extremely gravelly loamy sand.

Permeability is moderate in the subsoil of the Segundo soil and moderately rapid in the substratum. Available water capacity is 4 to 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 mainly for livestock grazing. It also is used for timber production, and it provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on the Anatone soil is dominated by bluebunch wheatgrass, squaw apple, and mountain big sagebrush.

Bluebunch wheatgrass is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 1,100 pounds per acre in favorable years and 500 pounds per acre in unfavorable years. Livestock access is limited by the extremely stony surface layer.

If the condition of the site deteriorates through overgrazing, bluebunch wheatgrass loses vigor and decreases in extent. Sandberg bluegrass, mountain big sagebrush, and perennial forbs increase in extent. If deterioration continues, cheatgrass, soft brome, and other annual plants invade the site.

Mechanical treatment for brush control and range seeding is not practical because of the slope and the stoniness of the surface layer.

Woodland.—The Segundo soil is suited to the production of ponderosa pine. The mean site index is 71 for ponderosa pine (100-year base age). The potential production at culmination of the mean annual increment for ponderosa pine is 56 cubic feet per acre per year (3.9 cubic meters per hectare per year) in a 50-year-old, even-aged, fully stocked stand.

The main concerns in producing and harvesting timber are the hazard of erosion, the equipment limitation, seedling mortality, plant competition, and fire damage to the soil.

Minimizing the risk of erosion is essential in areas where timber is harvested. Properly designed road drainage systems that include carefully located culverts help to control erosion. Spoil from excavations is subject to rill and gully erosion and to sloughing. Roads, landings, skid trails, and firebreaks can be protected against erosion by constructing water bars and by seeding areas that have been cut and filled. Buffer strips may be needed in areas adjacent to perennial streams to minimize siltation and maintain stream temperatures.

The slope restricts the use of wheeled and tracked equipment on skid trails. High-lead or other logging systems that fully or partially suspend the logs above the ground will damage the soil less than tractor systems and reduce the risk of compaction. The risk of compaction also can be reduced by using low-pressure ground equipment, laying out skid trails in advance, and harvesting timber when the soil is dry or frozen.

Careful management of reforestation is needed to minimize competition from undesirable plants. If the site is not adequately prepared, plant competition can prevent or delay reestablishment of volunteer or planted trees. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying. Scarification is severely restricted in the steeper areas because of increased expense and soil displacement.

The seedling mortality rate is increased by compaction of the surface layer and by droughtiness in the surface layer. The high content of rock fragments also limits seedling survival. To compensate for the higher expected mortality rate, larger seedlings or a greater number of seedlings than is typical can be planted. Shading and mulching of seedlings may be required. The trees that are suitable for planting include ponderosa pine.

Decline in forest productivity is likely to result from fire of moderate intensity.

Grazable woodland.—The Segundo soil is suitable for use as grazable woodland. The understory consists mainly of common snowberry, spirea, elk sedge, pinegrass, low Oregongrape, and strawberry.

This soil can produce adequate forage for big game animals after the tree canopy is opened by logging, fire, or some other disturbance. Dense stands of timber should be left in some areas to provide escape and thermal cover for the big game animals.

The Anatone soil is in the Mountain Shallow South 16-20pz range site. The Segundo soil is in the Pine-Fir-Sedge woodland understory site.

2F—Anatone-Segundo complex, 50 to 70 percent south slopes. This map unit is on mountains. Areas are irregular in shape and are 40 to 400 acres in size. The native vegetation is mainly conifers, shrubs, bunchgrasses, and forbs. Elevation is 4,000 to 6,000 feet. The average annual precipitation is 16 to 30 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 60 to 90 days.

This unit is about 55 percent Anatone extremely stony loam and 30 percent Segundo very gravelly loam. The Anatone soil is used as rangeland, and the Segundo soil is used as woodland. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of Baldridge soils and Rock outcrop. Also included are small areas of Stavely and Klicker soils. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Anatone soil is shallow and well drained. It formed in colluvium derived from rhyolite, andesite, and basalt. Typically, the surface layer is black extrmely stony loam about 8 inches thick. The subsoil is very dark brown extremely cobbly loam about 8 inches thick. The depth to bedrock is 10 to 20 inches.

Permeability is moderate in the Anatone soil. Available water capacity is 1 to 2 inches. The effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is very high.

The Segundo soil is deep and well drained. It formed in colluvium derived from rhyolite and andesite. Typically, the surface layer is very dark brown very gravelly loam about 5 inches thick. The subsoil is brown very gravelly loam about 16 inches thick. The substratum to a depth of 60 inches or more is brown very gravelly sandy loam and multicolored extremely gravelly loamy sand.

Permeability is moderate in the subsoil of the Segundo soil and moderately rapid in the substratum. Available water capacity is 4 to 7 inches. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is very high.

This unit is used mainly for timber production and livestock grazing. It also provides habitat for many kinds of wildlife.

Woodland.—The Segundo soil is suited to the production of ponderosa pine. The mean site index is 71 for ponderosa pine (100-year base age). The potential production at culmination of the mean annual increment for ponderosa pine is 56 cubic feet per acre per year (3.9 cubic meters per hectare per year) in a 50-year-old, even-aged, fully stocked stand.

The main concerns in producing and harvesting timber are the hazard of erosion, the equipment limitation, seedling mortality, plant competition, and fire damage to the soil.

Minimizing the risk of erosion is essential in areas where timber is harvested. Properly designed road drainage systems that include carefully located culverts help to control erosion. Spoil from excavations is subject to rill and gully erosion and to sloughing. Roads and landings can be protected against erosion by constructing water bars and by seeding areas that have been cut and filled. Buffer strips may be needed in areas adjacent to perennial streams to minimize siltation and maintain stream temperatures.

The slope prevents the use of wheeled and tracked equipment. High-lead or other logging systems that fully suspend the logs above the ground will damage the soil less than other systems. The risk of compaction can be reduced by using suitable harvesting methods and by harvesting when the soil is dry or frozen.

Careful management of reforestation is needed to minimize competition from undesirable plants. If the site is not adequately prepared, plant competition can prevent or delay reestablishment of volunteer or planted trees. Competing weeds, brush, or trees can be controlled by spraying, cutting, or girdling.

The seedling mortality rate is increased by compaction of the surface layer and by droughtiness in the surface layer. The high content of rock fragments also limits seedling survival. To compensate for the higher expected mortality rate, larger seedlings or a greater number of seedlings than is typical can be planted. Shading and mulching of seedlings may be required. The trees that are suitable for planting include ponderosa pine.

Decline in forest productivity is likely to result from fire of moderate intensity.

The understory consists mainly of common snowberry, spirea, elk sedge, pinegrass, low Oregongrape, and strawberry.

This soil can produce adequate forage for big game animals after the tree canopy is opened by logging, fire, or some other disturbance. Dense stands of timber should be left in some areas to provide escape and thermal cover for the big game animals.

Livestock grazing.—The potential plant community on the Anatone soil is dominated by bluebunch wheatgrass, squaw apple, mountain big sagebrush, and antelope bitterbrush.

Bluebunch wheatgrass is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 1,100 pounds per acre in favorable years and 500 pounds per acre in unfavorable years. Livestock access is limited by the slope and the extremely stony surface layer.

If the condition of the site deteriorates through overgrazing, bluebunch wheatgrass loses vigor and decreases in extent. Sandberg bluegrass, mountain big sagebrush, and perennial forbs increase in extent. If deterioration continues, cheatgrass, soft brome, and other annual plants invade the site.

Mechanical treatment for brush control and range seeding is not practical because of the slope and the stoniness of the surface layer.

The Anatone soil is in the Mountain Shallow South 16-20pz range site. The Segundo soil is in the Pine-Fir-Sedge woodland understory site.

3F—Angelpeak gravelly silt loam, 30 to 80 percent north slopes. This deep, well drained soil is on mountains. It formed in colluvium derived from argillite and influenced by volcanic ash in the surface layer. Areas are irregular in shape and are 100 to 800 acres in size. The native vegetation is mainly conifers, shrubs, and grasses. Elevation is 6,200 to 8,500 feet. The average annual precipitation is 30 to 40 inches, the average annual air temperature is 35 to 40 degrees F, and the average frost-free period is 20 to 40 days.

Typically, the surface is covered with a mat of partially decomposed needles, leaves, and twigs about 2 inches thick. The surface layer is dark brown gravelly silt loam about 11 inches thick. The subsoil is dark brown gravelly loam about 12 inches thick. The upper 18 inches of the substratum is brown extremely gravelly loam. The lower 11 inches is brown extremely gravelly sandy loam. The depth to bedrock is 40 to 60 inches.

Included in this unit are small areas of soils that are similar to the Angelpeak soil but are less than 40 inches deep over bedrock. Also included are small areas of Rock outcrop. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate to a depth of about 23 inches in the Angelpeak soil and moderately rapid below that depth. Available water capacity is 5 to 8 inches. The effective rooting depth is 40 to 60 inches. Runoff is rapid, and the hazard of water erosion is high or very high.

The Angelpeak soil is used mainly for timber production. It also provides habitat for many kinds of wildlife.

Woodland.—This unit is suited to the production of subalpine fir and western larch. The mean site index is 54 for subalpine fir (100-year base age) and 31 for western larch (50-year base age). The potential production at culmination of the mean annual increment for subalpine fir is 43 cubic feet per acre per year (3.0 cubic meters per hectare per year) in a 125-year-old, even-aged, fully stocked stand and for western larch is 32 cubic feet per acre per year (2.2 cubic meters per hectare per year) in a 70-year-old, even-aged, fully stocked stand.

The main concerns in producing and harvesting timber are the hazard of erosion, the equipment limitation, and fire damage to the soil.

Minimizing the risk of erosion is essential in areas where timber is harvested. Properly designed road drainage systems that include carefully located culverts help to control erosion. Spoil from excavations is subject to rill and gully erosion and to sloughing. Roads and landings can be protected against erosion by constructing water bars and by seeding areas that have been cut and filled. Buffer strips may be needed in areas adjacent to perennial streams to minimize siltation and maintain stream temperatures.

The slope prevents the use of wheeled and tracked equipment. High-lead or other logging systems that fully suspend the logs above the ground will damage the soil less than other systems. The risk of compaction can be reduced by using suitable harvesting methods and by harvesting when the soil is dry or frozen.

Careful management of reforestation is needed to minimize competition from undesirable plants. If the site is not adequately prepared, plant competition can prevent or delay reestablishment of volunteer or planted trees. Competing weeds, brush, or trees can be controlled by spraying, cutting, or girdling. The trees that are suitable for planting include Engelmann spruce, lodgepole pine, and western larch.

Some decline in forest productivity may result from fire of moderate intensity.

The understory consists mainly of grouse blueberry, princes pine, myrtle pachystima, elk sedge, pyrola, and heartleaf arnica.

This soil can produce adequate forage for big game animals after the tree canopy is opened by logging, fire, or some other disturbance. Dense stands of timber should be left in some areas to provide escape and thermal cover for the big game animals.

The Angelpeak soil is in the Subalpine Fir-Grouse Blueberry woodland understory site.

4B—Applegate silt loam, 2 to 7 percent slopes. This deep, well drained soil is on foot slopes, fans, and gently sloping terraces. It formed in alluvium and colluvium. Areas are irregular in shape and are 20 to 200 acres in size. The native vegetation is mainly shrubs, grasses, and scattered pine trees. Elevation is 2,500 to 3,600 feet. The average annual precipitation is 18 to 22 inches, the average annual air temperature is 45 to 48 degrees F, and the average frost-free period is 100 to 130 days.

Typically, the surface layer is dark brown silt loam about 11 inches thick. The upper 17 inches of the subsoil is dark reddish brown silty clay loam. The lower 32 inches is dark reddish brown clay. The depth to bedrock is typically more than 60 inches but is 40 to 60 inches in some areas.

Included in this unit are small areas of Top, Immig, and Langrell soils. Also included are small areas of soils that are similar to the Applegate soil but are less than 40 inches deep over bedrock and small areas of a moderately deep soil that has a duripan. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is slow in the Applegate soil. Available water capacity is 9 to 11 inches. The effective rooting depth is typically more than 60 inches but is 40 to 60 inches in some areas. Runoff is slow, and the hazard of water erosion is slight or moderate.

Most areas are used for irrigated hay and pasture. A few areas are used for small grain or homesite development. This unit also provides habitat for many kinds of wildlife.

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

Management that maintains the optimum vigor and quality of forage plants is needed. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and control erosion. Periodic mowing and clipping help to maintain uniform growth and prevent selective grazing.

In summer irrigation is needed for maximum crop production. Irrigation water can be applied by the controlled surface or sprinkler methods. Sprinkler irrigation permits the even, controlled application of water, helps to control runoff, and minimizes the risk of erosion. To avoid 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.

Fertilizer is needed to ensure the optimum growth of grasses and legumes. 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.

Conducting fieldwork during wet periods results in deterioration of tilth and destroys soil structure. As a result, it increases the runoff rate and the hazard of erosion. Runoff and erosion can be controlled by crop residue management and by rough or minimum tillage. All tillage should be on the contour or across the slope.

Grazing during wet periods results in compaction of the surface layer, poor tilth, and excessive runoff. Compaction limits the movement of air and water in the soil and restricts the growth of roots.

A wide variety of trees and shrubs can be grown as windbreaks and environmental plantings on this soil. Cultivation or applications of herbicide help to remove competing vegetation.

Homesite development.—If this unit is used for homesite development, the main limitations are the slow permeability in the clayey subsoil, the shrink-swell potential, and low strength.

On sites for septic tank absorption fields, the slow permeability can be overcome by increasing the size of the absorption fields. Properly designing the foundations and footings of buildings and diverting runoff away from the buildings help to prevent the structural damage caused by shrinking and swelling. The risk of settlement can be minimized by compacting the site before construction. On sites for roads large amounts of base rock are needed to prevent settling. Properly designing the roads helps to offset the limited ability of the soil to support a load.

The Applegate soil is in the Clayey 17-22pz range site.

4C—Applegate silt loam, 7 to 15 percent slopes. This deep, well drained soil is on foot slopes, fans, and gently sloping terraces. It formed in alluvium and colluvium. Areas are irregular in shape and are 20 to 200 acres in size. The native vegetation is mainly shrubs, grasses, and scattered pine trees. Elevation is 2,500 to 3,600 feet. The average annual precipitation is 18 to 22 inches, the average annual air temperature is 45 to 48 degrees F, and the average frost-free period is 100 to 130 days.

Typically, the surface layer is dark brown silt loam about 11 inches thick. The upper 17 inches of the subsoil is dark reddish brown silty clay loam. The lower 32 inches is dark reddish brown clay. The depth to bedrock is typically more than 60 inches but is 40 to 60 inches in some areas.

Included in this unit are small areas of Top and Immig soils. Also included are small areas of soils that are similar to the Applegate soil but are less than 40 inches deep over bedrock. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is slow in the Applegate soil. Available water capacity is 9 to 11 inches. The effective rooting depth is typically more than 60 inches but is 40 to 60 inches in some areas. Runoff is medium, and the hazard of water erosion is moderate.

Most areas are used for irrigated hay and pasture. A few areas are used for small grain or homesite development. This unit also provides habitat for many kinds of wildlife.

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

Management that maintains the optimum vigor and quality of forage plants is needed. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and control erosion. Periodic mowing and clipping help to maintain uniform growth and prevent selective grazing.

In summer irrigation is needed for maximum crop production. Sprinkler irrigation is a suitable method of applying water. It permits the even, controlled application of water, helps to control runoff, and minimizes the risk of erosion. To avoid 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.

Fertilizer is needed to ensure the optimum growth of grasses and legumes. 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.

Conducting fieldwork during wet periods results in deterioration of tilth and destroys soil structure. As a result, it increases the runoff rate and the hazard of erosion. Runoff and erosion can be controlled by crop residue management and by rough or minimum tillage. All tillage should be on the contour or across the slope.

Grazing during wet periods results in compaction of the surface layer, poor tilth, and excessive erosion. Compaction limits the movement of air and water in the soil and restricts the growth of roots.

A wide variety of trees and shrubs can be grown as windbreaks and environmental plantings on this soil. Cultivation or applications of herbicide help to remove competing vegetation.

Homesite development.—If this unit is used for homesite development, the main limitations are the slow permeability in the clayey subsoil, the shrink-swell potential, low strength, and the slope.

On sites for septic tank absorption fields, the slow permeability can be overcome by increasing the size of the absorption fields. The slope hinders installation of the absorption fields. The absorption lines should be installed on the contour. Properly designing the foundations and footings of buildings and diverting runoff away from the buildings help to prevent the structural damage caused by shrinking and swelling. The risk of settlement can be minimized by compacting the building site before construction. On sites for roads large amounts of base rock are needed to prevent settling. Properly designing the roads helps to offset the limited ability of the soil to support a load.

The Applegate soil is in the Clayey 17-22pz range site.

5C—Aridic Haploxerolls, 2 to 12 percent slopes. These deep, well drained soils are on alluvial fans. They formed in mixed colluvium and alluvium. Areas are conical and are 20 to 200 acres in size. The native vegetation is mainly bunchgrasses and shrubs. Elevation is 1,800 to 3,400 feet. The average annual precipitation is 9 to 12 inches, the average annual air

temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 150 days.

Typically, the surface layer is very dark brown very stony loam about 10 inches thick. The next layer is very dark brown very cobbly loam about 12 inches thick. The subsoil to a depth of 60 inches or more is dark brown very stony clay loam.

Included in this unit are small areas of soils that are similar to the Aridic Haploxerolls but have no stones on the surface. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate in the Aridic Haploxerolls. Available water capacity is 5 to 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 livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on this unit is dominated by bluebunch wheatgrass, Thurber needlegrass, and Wyoming big sagebrush.

Bluebunch wheatgrass and Thurber needlegrass are the major forage-producing plants. If the site is in excellent condition, the total annual production is estimated at 1,500 pounds per acre in favorable years and 500 pounds per acre in unfavorable years. Livestock access is limited by the very stony surface layer.

If the condition of the site deteriorates through overgrazing, bluebunch wheatgrass and Thurber needlegrass lose vigor and decrease in extent. Sandberg bluegrass, Wyoming big sagebrush, and perennial forbs increase in extent. If deterioration continues, cheatgrass and other annual plants invade the site.

Mechanical treatment for range seeding and brush control is not practical because of the stoniness of the surface layer.

The Aridic Haploxerolls are in the Loamy 9-12pz range site.

6C—Ateron very stony loam, 2 to 12 percent slopes. This shallow, well drained soil is on hills and ridgetops. It formed in colluvium derived from basalt. Areas are irregular in shape and are 40 to 200 acres in size. The native vegetation is mainly bunchgrasses, forbs, and shrubs. Elevation is 3,600 to 5,700 feet. The average annual precipitation is 12 to 16 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 50 to 95 days.

Typically, the surface layer is very dark gray very stony loam about 6 inches thick. The next layer is very dark grayish brown very cobbly silty clay loam about 6 inches thick. The subsoil is dark brown very cobbly clay. It extends to a depth of about 17 inches. The depth to bedrock is 10 to 20 inches.

Included in this unit are small areas of Snell soils and Rock outcrop. Also included are small areas of soils that are similar to the Ateron soil but are less than 10 inches deep over bedrock. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate to a depth of about 12 inches in the Ateron soil and slow below that depth. Available water capacity is 1 to 2 inches. The effective rooting depth is 10 to 20 inches. Runoff is slow or medium, and the hazard of water erosion is slight or moderate.

This unit is used mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on this unit is dominated by Idaho fescue and mountain big sagebrush.

Idaho fescue is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 1,500 pounds per acre in favorable years and 500 pounds per acre in unfavorable years. Livestock access is limited by surface stones.

If the condition of the site deteriorates through overgrazing, Idaho fescue loses vigor and decreases in extent. Sandberg bluegrass, mountain big sagebrush, and perennial forbs increase in extent. If deterioration continues, cheatgrass, soft brome, and other annual plants invade the site.

Mechanical treatment for brush control and range seeding is not practical because of the stoniness of the surface layer.

The Ateron soil is in the Mountain Shallow 12-16pz range site.

7D—Ateron very stony loam, 12 to 35 percent south slopes. This shallow, well drained soil is on hills. It formed in colluvium derived from basalt. Areas are irregular in shape and are 40 to 200 acres in size. The native vegetation is mainly bunchgrasses, forbs, and shrubs. Elevation is 3,600 to 5,700 feet. The average annual precipitation is 12 to 16 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 50 to 95 days.

Typically, the surface layer is very dark gray very stony loam about 6 inches thick. The next layer is very dark grayish brown very cobbly silty clay loam about 6 inches thick. The subsoil is dark brown very cobbly clay. It extends to a depth of about 17 inches. The depth to bedrock is 10 to 20 inches.

Included in this unit are small areas of Snell soils and Rock outcrop. Also included are small areas of soils that are similar to the Ateron soil but are less than 10 inches deep over bedrock. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate to a depth of about 12 inches in the Ateron soil and slow below that depth. Available water capacity is 1 to 2 inches. The effective rooting depth is 10 to 20 inches. Runoff is medium, and the hazard of water erosion is moderate or high.

This unit is used mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on this unit is dominated by bluebunch wheatgrass, squaw apple, and mountain big sagebrush.

Bluebunch wheatgrass is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 900 pounds per acre in favorable years and 400 pounds per acre in unfavorable years. Livestock access is limited by surface stones.

If the condition of the site deteriorates through overgrazing, bluebunch wheatgrass loses vigor and decreases in extent. Sandberg bluegrass, mountain big sagebrush, and perennial forbs increase in extent. If deterioration continues, cheatgrass, soft brome, and other annual plants invade the site.

Mechanical treatment for brush control and range seeding is not practical because of the stoniness of the surface layer.

The Ateron soil is in the Mountain Shallow South 12-16pz range site.

7E—Ateron very stony loam, 35 to 60 percent south slopes. This shallow, well drained soil is on hills. It formed in colluvium derived from basalt. Areas are irregular in shape and are 40 to 200 acres in size. The native vegetation is mainly bunchgrasses, forbs, and shrubs. Elevation is 3,600 to 5,700 feet. The average annual precipitation is 12 to 16 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 50 to 95 days.

Typically, the surface layer is very dark gray very stony loam about 6 inches thick. The next layer is very dark grayish brown very cobbly silty clay loam about 6 inches thick. The subsoil is dark brown very cobbly clay. It extends to a depth of about 17 inches. The depth to bedrock is 10 to 20 inches.

Included in this unit are small areas of Snell soils and Rock outcrop. Also included are small areas of soils that are similar to the Ateron soil but are less than 10 inches deep over bedrock. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate to a depth of about 12 inches in the Ateron soil and slow below that depth. Available water capacity is 1 to 2 inches. The effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is high or very high.

This unit is used mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on this unit is dominated by bluebunch wheatgrass, squaw apple, mountain big sagebrush, and antelope bitterbrush.

Bluebunch wheatgrass is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 900 pounds per acre in favorable years and 400 pounds per acre in unfavorable years. Livestock access is limited by the slope and surface stones.

If the condition of the site deteriorates through overgrazing, bluebunch wheatgrass loses vigor and decreases in extent. Sandberg bluegrass, mountain big sagebrush, and perennial forbs increase in extent. If deterioration continues, cheatgrass, soft brome, and other annual plants invade the site.

Mechanical treatment for range seeding and brush control is not practical because of the slope and the stoniness of the surface layer.

The Ateron soil is in the Mountain Shallow South 12-16pz range site.

8C—Ateron-Roostercomb extremely gravelly clay loams, 2 to 12 percent slopes. This map unit is on hills and ridgetops. Areas are irregular in shape and are 40 to 200 acres in size. The native vegetation is mainly bunchgrasses, shrubs, and forbs. Elevation is 3,800 to 5,700 feet. The average annual precipitation is 12 to 16 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 50 to 90 days.

This unit is about 55 percent Ateron extremely gravelly clay loam and 30 percent Roostercomb extremely gravelly clay loam. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of soils that are similar to the Ateron soil but are less than 10 inches deep over bedrock. Also included are small areas of Rock outcrop. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Ateron soil is shallow and well drained. It formed in colluvium derived from greenstone. Typically, the surface layer is very dark brown extremely gravelly clay loam about 6 inches thick. The next layer is very dark grayish brown extremely gravelly clay loam about 6 inches thick. The subsoil is dark brown extremely cobbly clay about 5 inches thick. The depth to bedrock is 10 to 20 inches.

Permeability is moderately slow to a depth of about 9 inches in the Ateron soil and slow below that depth. Available water capacity is 1 to 2 inches. The effective rooting depth is 10 to 20 inches. Runoff is slow or medium, and the hazard of water erosion is slight or moderate.

The Roostercomb soil is moderately deep and well drained. It formed in colluvium derived from greenstone. Typically, the surface layer is dark brown extremely gravelly clay loam about 12 inches thick. The upper 13 inches of the subsoil is dark yellowish brown extremely gravelly clay. The lower 11 inches is dark yellowish brown extremely cobbly clay. The depth to fractured bedrock is 20 to 40 inches.

Permeability is moderately slow to a depth of about 12 inches in the Roostercomb soil and slow below that depth. Available water capacity is 2 to 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.

This unit is used mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on the Ateron soil is dominated by onespike oatgrass, Sandberg bluegrass, stiff sagebrush, Idaho fescue, and lomatium.

Sandberg bluegrass, Idaho fescue, and onespike oatgrass are the major forage-producing plants. If the site is in excellent condition, the total annual production is estimated at 600 pounds per acre in favorable years and 200 pounds per acre in unfavorable years. Livestock access is limited by the rock fragments on the surface.

The potential plant community on the Roostercomb soil is dominated by Idaho fescue and big sagebrush.

Idaho fescue is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 2,000 pounds per acre in favorable years and 1,000 pounds per acre in unfavorable years. Livestock access is limited by the rock fragments on the surface.

If the condition of the site deteriorates through overgrazing, Idaho fescue, bluebunch wheatgrass, and onespike oatgrass lose vigor and decrease in extent. Sandberg bluegrass, mountain big sagebrush, and perennial forbs increase in extent. If deterioration continues, cheatgrass and other annual plants invade the site.

Brush management practices should be carefully evaluated before they are implemented in areas that support stiff sagebrush and bitterbrush. Range seeding is not practical because of the extremely gravelly surface layer.

The Ateron soil is in the Mountain Very Shallow 12-16pz range site. The Roostercomb soil is in the Mountain Clayey 12-16pz range site.

9D—Ateron-Roostercomb extremely gravelly clay loams, 12 to 35 percent south slopes. This map unit is on hills. Areas are irregular in shape and are 100 to 400 acres in size. The native vegetation is mainly bunchgrasses, shrubs, and forbs. Elevation is 3,800 to 5,700 feet. The average annual precipitation is 12 to 16 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 50 to 90 days.

This unit is about 50 percent Ateron extremely gravelly clay loam and 35 percent Roostercomb extremely gravelly clay loam. The unit is on complex slopes. The Ateron soil is in convex areas, and the Roostercomb soil is in concave areas. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of soils that are similar to the Ateron soil but are less than 10 inches deep over bedrock. Also included are small areas of Rock outcrop. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Ateron soil is shallow and well drained. It formed in colluvium derived from greenstone. Typically, the surface layer is very dark brown extremely gravelly clay loam about 6 inches thick. The next layer is very dark grayish brown extremely gravelly clay loam about 6 inches thick. The subsoil is dark brown extremely cobbly clay about 5 inches thick. The depth to bedrock is 10 to 20 inches.

Permeability is moderately slow to a depth of about 9 inches in the Ateron soil and slow below that depth. Available water capacity is 1 to 2 inches. The effective rooting depth is 10 to 20 inches. Runoff is medium, and the hazard of water erosion is moderate or high.

The Roostercomb soil is moderately deep and well drained. It formed in colluvium derived from greenstone. Typically, the surface layer is dark brown extremely gravelly clay loam about 12 inches thick. The upper 13 inches of the subsoil is dark yellowish brown extremely gravelly clay. The lower 11 inches is dark yellowish brown extremely cobbly clay. The depth to fractured bedrock is 20 to 40 inches.

Permeability is moderately slow to a depth of about 12 inches in the Roostercomb soil and slow below that depth. Available water capacity is 2 to 4 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 mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on the Ateron soil is dominated by bluebunch wheatgrass, mountain big sagebrush, bitterbrush, and squaw apple.

Bluebunch wheatgrass is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 900 pounds per acre in favorable years and 400 pounds per acre in unfavorable years. Livestock access is limited by the rock fragments on the surface.

The potential plant community on the Roostercomb soil is dominated by bluebunch wheatgrass, Idaho fescue, mountain big sagebrush, squaw apple, and bitterbrush.

Bluebunch wheatgrass and Idaho fescue are the major forage-producing plants. If the site is in excellent condition, the total annual production is estimated at 1,400 pounds per acre in favorable years and 700 pounds per acre in unfavorable years. Livestock access is limited by the rock fragments on the surface.

If the condition of the site deteriorates through overgrazing, bluebunch wheatgrass and Idaho fescue lose vigor and decrease in extent. Sandberg bluegrass, mountain big sagebrush, and perennial forbs increase in extent. If deterioration continues, cheatgrass, soft brome, and other annual plants invade the site.

Range seeding is not practical because of the extremely gravelly surface layer.

The Ateron soil is in the Mountain Shallow South 12-16pz range site. The Roostercomb soil is in the Mountain South 12-16pz range site.

9E—Ateron-Roostercomb extremely gravelly clay loams, 35 to 60 percent south slopes. This map unit is on hills. Areas are irregular in shape and are 40 to 400 acres in size. The native vegetation is mainly bunchgrasses, shrubs, and forbs. Elevation is 3,800 to 5,700 feet. The average annual precipitation is 12 to 16 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 50 to 90 days.

This unit is about 55 percent Ateron extremely gravelly clay loam and 30 percent Roostercomb extremely gravelly clay loam. The unit is on complex slopes. The Ateron soil is in convex areas, and the Roostercomb soil is in concave areas. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of soils that are similar to the Ateron soil but are less than 10 inches deep over bedrock. Also included are small areas of Rock outcrop. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Ateron soil is shallow and well drained. It formed in colluvium derived from greenstone. Typically, the surface layer is very dark brown extremely gravelly clay loam about 6 inches thick. The next layer is very dark grayish brown extremely gravelly clay loam about 6 inches thick. The subsoil is dark brown extremely cobbly clay about 5 inches thick. The depth to bedrock is 10 to 20 inches.

Permeability is moderately slow to a depth of about 9 inches in the Ateron soil and slow below that depth. Available water capacity is 1 to 2 inches. The effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is high or very high.

The Roostercomb soil is moderately deep and well drained. It formed in colluvium derived from greenstone. Typically, the surface layer is dark brown extremely gravelly clay loam about 12 inches thick. The upper 13 inches of the subsoil is dark yellowish brown extremely gravelly clay. The lower 11 inches is dark yellowish brown extremely cobbly clay. The depth to fractured bedrock is 20 to 40 inches.

Permeability is moderately slow to a depth of about 11 inches in the Roostercomb soil and slow below that depth. Available water capacity is 2 to 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high or very high.

This unit is used mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on the Ateron soil is dominated by bluebunch wheatgrass, mountain big sagebrush, basin big sagebrush, bitterbrush, and squaw apple.

Bluebunch wheatgrass and Sandberg bluegrass are the major forage-producing plants. If the site is in excellent condition, the total annual production is estimated at 1,400 pounds per acre in favorable years and 700 pounds per acre in unfavorable years. Livestock access is limited by the slope and the rock fragments on the surface.

The potential plant community on the Roostercomb soil is dominated by bluebunch wheatgrass, Idaho fescue, mountain big sagebrush, squaw apple, and bitterbrush.

Bluebunch wheatgrass and Idaho fescue are the major forage-producing plants. If the site is in excellent condition, the total annual production is estimated at 1,400 pounds per acre in favorable years and 700 pounds per acre in unfavorable years. Livestock access is limited by the slope and the rock fragments on the surface.

If the condition of the site deteriorates through overgrazing, bluebunch wheatgrass and Idaho fescue lose vigor and decrease in extent. Sandberg bluegrass, mountain big sagebrush, and perennial forbs increase in extent. If deterioration continues, cheatgrass, soft brome, and other annual plants invade the site.

Mechanical treatment for brush control and range seeding is not practical because of the slope and the extremely gravelly surface layer.

The Ateron soil is in the Mountain Shallow South 12-16pz range site. The Roostercomb soil is in the Mountain South 12-16pz range site.

10C—Bakeoven-Ruckles complex, 2 to 12 percent slopes. This map unit is on ridgetops. Areas are irregular in shape and are 40 to 200 acres in size. The native vegetation is mainly bunchgrasses and forbs. Elevation is 2,000 to 3,600 feet. The average annual precipitation is 10 to 12 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 130 days.

This unit is about 50 percent Bakeoven extremely gravelly loam and 40 percent Ruckles very stony clay loam. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of Ruclick soils. Also included are small areas of Rock outcrop. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

The Bakeoven soil is very shallow and well drained. It formed in loess and in colluvium derived from basalt. Typically, the surface layer is very dark grayish brown extremely gravelly loam about 2 inches thick. The subsoil is dark brown extremely cobbly clay about 6 inches thick. The depth to bedrock is 4 to 10 inches.

Permeability is moderately slow in the Bakeoven soil. Available water capacity is 0.5 inch to 1.5 inches. The effective rooting depth is 4 to 10 inches. Runoff is slow or medium, and the hazard of water erosion is slight or moderate.

The Ruckles soil is shallow and well drained. It formed in colluvium derived from basalt and influenced by loess and volcanic ash in the surface layer. Typically, the surface layer is very dark grayish brown very stony clay loam about 5 inches thick. The subsoil is very stony clay. The upper 3 inches is dark brown, and the lower 3 inches is dark yellowish brown. The substratum is brown extremely stony sandy clay. It extends to a depth of about 16 inches. The depth to bedrock is 10 to 20 inches.

Permeability is slow in the Ruckles soil. Available water capacity is 1 to 2 inches. The effective rooting depth is 10 to 20 inches. Runoff is slow or medium, and the hazard of water erosion is slight or moderate.

This unit is used mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on the Bakeoven soil is dominated by Sandberg bluegrass and stiff sagebrush.

Sandberg bluegrass is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 400 pounds per acre in favorable years and 100 pounds per acre in unfavorable years. Livestock access is limited by the rock fragments on the surface.

The potential plant community on the Ruckles soil is dominated by Idaho fescue and Wyoming big sagebrush.

Idaho fescue is the major forage-producing plant. If the site is in excellent condition, the total annual production is 1,200 pounds per acre in favorable years and 300 pounds per acre in unfavorable years. Livestock access is limited by the rock fragments on the surface.

If the condition of the site deteriorates through overgrazing, Idaho fescue loses vigor and decreases in extent. Sandberg bluegrass, Wyoming big sagebrush, and perennial forbs increase in extent. If deterioration continues, cheatgrass and other annual plants invade the site.

Brush management is not recommended in areas of the Bakeoven soil where stiff sagebrush has important wildlife and some livestock food value. Mechanical treatment for brush control on the Ruckles soil is not practical because of the very stony surface layer.

The Bakeoven soil is in the Very Shallow 10-14pz range site. The Ruckles soil is in the Mountain Shallow 9-12pz range site.

11A—Baker silt loam, 0 to 2 percent slopes. This well drained soil is on low terraces. It is moderately deep to a duripan. It formed in old alluvium influenced by mixed volcanic ash and loess in the surface layer. Areas are long and rectangular and are 40 to 200 acres in size. The native vegetation is mainly bunchgrasses, forbs, and shrubs. Elevation is 2,000 to 3,500 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 45 to 48 degrees F, and the average frost-free period is 110 to 125 days.

Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. The upper part of the subsoil is dark brown and brown silt loam about 8 inches thick. The next part is brown loam about 15 inches thick. The lower part is a duripan about 8 inches thick. The substratum to a depth of 60 inches or more is

Figure 5.—Alfalfa hay on Baker silt loam, 0 to 2 percent slopes.

multicolored extremely gravelly sand. The depth to a duripan generally is 20 to 40 inches. In some areas it is less than 20 inches. In places the soil has a weakly cemented hardpan instead of a duripan.

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

Permeability is moderate above the duripan in the Baker soil. Available water capacity is 5 to 8 inches. The effective rooting depth is 20 to 40 inches. Runoff is slow, and the hazard of water erosion is slight.

Most areas are used for irrigated hay and pasture (fig. 5) or small grain. A few areas are used for homesite development. This unit also provides habitat for many kinds of wildlife.

Hay and pasture or cropland.—If this unit is used for hay and pasture or small grain, the main limitation is the rooting depth. Ripping and shattering the duripan increase the effective rooting depth and improve internal drainage.

Management that maintains the optimum vigor and quality of forage plants is needed. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and control erosion. Periodic mowing and clipping help to maintain uniform growth and prevent selective grazing.

In summer irrigation is needed for maximum crop production. Irrigation water can be applied by the controlled surface or sprinkler methods. Sprinkler irrigation permits the even, controlled application of water and helps to control runoff. To avoid 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.

Fertilizer is needed to ensure the optimum growth of grasses, legumes, and other crops. 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.

Conducting fieldwork during wet periods results in deterioration of tilth and destroys soil structure. As a result, it increases the runoff rate and the hazard of erosion. Runoff and erosion can be controlled by crop residue management and by rough or minimum tillage.

Grazing during wet periods results in compaction of the surface layer, poor tilth, and excessive runoff. Compaction limits the movement of air and water in the soil and restricts the growth of roots.

The trees and shrubs grown as windbreaks and environmental plantings should be those that are tolerant of a high content of lime and drought. The free carbonates in the soil tie up minerals and limit their availability. A very low available water capacity may cause severe seedling mortality. Continued cultivation, mulching, or applications of herbicide to control competing vegetation are needed to ensure the establishment and survival of seedlings.

Homesite development.—If this unit is used for homesite development, the main limitations are the moderate depth to a duripan, the sandy substratum, and a moderate potential for frost action.

On sites for septic tank absorption fields, the moderate depth to a duripan can be overcome by ripping the duripan. Retainer walls should be constructed in shallow excavations to keep cutbanks from caving in. Properly designing foundations, footings, and roads helps to offset the moderate potential for frost action.

The Baker soil is in the Mountain Loamy 9-12pz range site.

11B—Baker silt loam, 2 to 7 percent slopes. This well drained soil is on low terraces. It is moderately deep to a duripan. It formed in old alluvium influenced by mixed volcanic ash and loess in the surface layer. Areas are long and rectangular and are 40 to 200 acres in size. The native vegetation is mainly bunchgrasses, forbs, and shrubs. Elevation is 2,600 to 3,500 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 45 to 48 degrees F, and the average frost-free period is 110 to 125 days.

Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. The upper part of the subsoil is dark brown and brown silt loam about 8 inches thick. The next part is brown loam about 15 inches thick. The lower part is a duripan about 8 inches thick. The substratum to a depth of 60 inches or more is multicolored extremely gravelly sand. The depth to a duripan generally is 20 to 40 inches. In some areas it is less than 20 inches. In places the soil has a weakly cemented hardpan instead of a duripan.

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

Permeability is moderate above the duripan in the Baker soil. Available water capacity is 5 to 8 inches. The effective rooting depth is 20 to 40 inches. Runoff is slow, and the hazard of water erosion is slight or moderate.

Most areas are used for irrigated hay and pasture. A few areas are used for small grain or homesite development. This unit also provides habitat for many kinds of wildlife.

Hay and pasture.—If this unit is used for hay and pasture, the main limitation is the rooting depth. Ripping and shattering the duripan increase the effective rooting depth and improve internal drainage.

Management that maintains the optimum vigor and quality of forage plants is needed. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and control erosion. Periodic mowing and clipping help to maintain uniform growth and prevent selective grazing.

In summer irrigation is needed for the maximum production of most crops. Irrigation water can be applied by the sprinkler method. Sprinkler irrigation permits the even, controlled application of water and helps to control runoff. To avoid 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.

Fertilizer is needed to ensure the optimum growth of grasses, legumes, and other crops. 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.

Conducting fieldwork during wet periods results in deterioration of tilth and destroys soil structure. As a result, it increases the runoff rate and the hazard of erosion. Runoff and erosion can be controlled by crop residue management and by rough or minimum tillage. All tillage should be on the contour or across the slope.

Grazing during wet periods results in compaction of the surface layer, poor tilth, and excessive runoff. Compaction limits the movement of air and water in the soil and restricts the growth of roots.

The trees and shrubs grown as windbreaks and environmental plantings should be those that are tolerant of a high content of lime and drought. The free carbonates in the soil tie up minerals and limit their availability. A very low available water capacity may cause severe seedling mortality. Continued cultivation, mulching, or applications of herbicide to control competing vegetation are needed to ensure the establishment and survival of seedlings.

Homesite development.—If this unit is used for homesite development, the main limitations are the moderate depth to a duripan, the sandy substratum, a moderate potential for frost action, and the slope.

On sites for septic tank absorption fields, the moderate depth to a duripan can be overcome by ripping the duripan. Retainer walls should be constructed in shallow excavations to keep cutbanks from caving in. Properly designing foundations, footings, and roads helps to offset the moderate potential for frost action. In the steeper areas the hazard of erosion can be reduced by disturbing only the part of the site that is used for construction.

The Baker soil is in the Mountain Loamy 9-12pz range site.

12A—Baker silt loam, 0 to 2 percent slopes, warm. This well drained soil is on low terraces. It is moderately deep to a duripan. It formed in old alluvium influenced by mixed volcanic ash and loess in the surface layer. Areas are long and rectangular and are 40 to 200 acres in size. The native vegetation is mainly bunchgrasses, forbs, and shrubs. Elevation is 2,000 to 2,600 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 48 to 50 degrees F, and the average frost-free period is 125 to 140 days.

Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. The upper part of the subsoil is dark brown and brown silt loam about 8 inches thick. The next part is brown loam about 15 inches thick. The lower part is a duripan about 8 inches thick. The substratum to a depth of 60 inches or more is multicolored extremely gravelly sand. The depth to a duripan generally is 20 to 40 inches. In some areas it is less than 20 inches. In places the soil has a weakly cemented hardpan instead of a duripan.

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

Permeability is moderate above the duripan in the Baker soil. Available water capacity is 5 to 8 inches. The effective rooting depth is 20 to 40 inches. Runoff is slow, and the hazard of water erosion is slight.

Most areas are used for irrigated hay and pasture or for small grain. A few areas are used for irrigated row crops or for homesite development. This unit also provides habitat for many kinds of wildlife.

Hay and pasture or cropland.—If this unit is used as hayland, pasture, or cropland, the main limitation is the rooting depth. Ripping and shattering the duripan increase the effective rooting depth and improve internal drainage.

Management that maintains the optimum vigor and quality of forage plants is needed. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and control erosion. Periodic mowing and clipping help to maintain uniform growth and prevent selective grazing.

In summer irrigation is needed for the maximum production of most crops. Irrigation water can be applied by the controlled surface or sprinkler methods. Sprinkler irrigation permits the even, controlled application of water and helps to control runoff. To avoid 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.

Fertilizer is needed to ensure the optimum growth of grasses, legumes, and other crops. 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.

Conducting fieldwork during wet periods results in deterioration of tilth and destroys soil structure. As a result, it increases the runoff rate and the hazard of erosion. Runoff and erosion can be controlled by crop residue management and by rough or minimum tillage.

Grazing during wet periods results in compaction of the surface layer, poor tilth, and excessive runoff. Compaction limits the movement of air and water in the soil and restricts the growth of roots.

The trees and shrubs grown as windbreaks and environmental plantings should be those that are tolerant of a high content of lime and drought. The free carbonates in the soil tie up minerals and limit their availability. A very low available water capacity may cause severe seedling mortality. Continued cultivation, mulching, or applications of herbicide to control competing vegetation are needed to ensure the establishment and survival of seedlings.

Homesite development.—If this unit is used for homesite development, the main limitations are the moderate depth to a duripan, the sandy substratum, and a moderate potential for frost action.

On sites for septic tank absorption fields, the moderate depth to a duripan can be overcome by ripping the duripan. Retainer walls should be constructed in shallow excavations to keep cutbanks from caving in. Properly designing foundations, footings, and roads helps to offset the moderate potential for frost action.

The Baker soil is in the Loamy 9-12pz range site.

12B—Baker silt loam, 2 to 7 percent slopes, warm. This well drained soil is on low terraces. It is moderately deep to a duripan. It formed in old alluvium influenced by mixed volcanic ash and loess in the surface layer. Areas are long and rectangular and are 40 to 200 acres in size. The native vegetation is mainly bunchgrasses, forbs, and shrubs. Elevation is 2,000 to 2,600 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 48 to 50 degrees F, and the average frost-free period is 125 to 140 days.

Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. The upper part of the subsoil is dark brown and brown silt loam about 8 inches thick. The next part is brown loam about 15 inches thick. The lower part is a duripan about 8 inches thick. The substratum to a depth of 60 inches or more is multicolored extremely gravelly sand. The depth to a duripan generally is 20 to 40 inches. In some areas it is less than 20 inches. In places the soil has a weakly cemented hardpan instead of a duripan.

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

Permeability is moderate above the duripan in the Baker soil. Available water capacity is 5 to 8 inches. The effective rooting depth is 20 to 40 inches. Runoff is slow, and the hazard of water erosion is slight or moderate.

Most areas are used for irrigated hay and pasture. A few areas are used for small grain or homesite development. This unit also provides habitat for many kinds of wildlife.

Hay and pasture.—If this unit is used for hay and pasture, the main limitation is the rooting depth. Ripping and shattering the duripan increase the effective rooting depth and improve internal drainage.

Management that maintains the optimum vigor and quality of forage plants is needed. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and control erosion. Periodic mowing and clipping help to maintain uniform growth and prevent selective grazing.

In summer irrigation is needed for the maximum production of most crops. Irrigation water can be applied by the sprinkler method. Sprinkler irrigation permits the even, controlled application of water and helps to control runoff. To avoid 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.

Fertilizer is needed to ensure the optimum growth of grasses, legumes, and other crops. 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.

Conducting fieldwork during wet periods results in deterioration of tilth and destroys soil structure. As a result, it increases the runoff rate and the hazard of erosion. Runoff and erosion can be controlled by crop residue management and by rough or minimum tillage. All tillage should be on the contour or across the slope.

Grazing during wet periods results in compaction of the surface layer, poor tilth, and excessive runoff. Compaction limits the movement of air and water in the soil and restricts the growth of roots.

The trees and shrubs grown as windbreaks and environmental plantings should be those that are tolerant of a high content of lime and drought. The free carbonates in the soil tie up minerals and limit their availability. A very low available water capacity may cause severe seedling mortality. Continued cultivation, mulching, or applications of herbicide to control competing vegetation are needed to ensure the establishment and survival of seedlings.

Homesite development.—If this unit is used for homesite development, the main limitations are the moderate depth to a duripan, the sandy substratum, a moderate potential for frost action, and the slope.

On sites for septic tank absorption fields, the moderate depth to a duripan can be overcome by ripping the duripan. Retainer walls should be constructed in shallow excavations to keep cutbanks from caving in. Properly designing foundations, footings, and roads helps to offset the moderate potential for frost action. In the steeper areas the hazard of erosion can be reduced by disturbing only the part of the site that is used for construction.

The Baker soil is in the Loamy 9-12pz range site.

13A—Baldock silt loam, 0 to 2 percent slopes. This deep, poorly drained soil is on flood plains. It formed in mixed alluvium. Areas are elongated and are 20 to 200 acres in size. The native vegetation is mainly water-tolerant grasses and sedges. Elevation is 2,000 to 3,600 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 46 to 50 degrees F, and the average frost-free period is 110 to 140 days.

Typically, the surface layer is very dark grayish brown and very dark gray silt loam about 6 inches thick. The next layer is dark gray silt loam about 12 inches thick. The upper part of the substratum is dark gray, mottled silt loam. It extends to a depth of about 36 inches. The lower part to a depth of 60 inches or more is gleyed dark grayish brown silt loam.

Included in this unit are small areas of Balm, Haines, and Boyce soils. Also included are small areas of Wingdale and Wingville soils. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate in the Baldock soil. Available water capacity is 9 to 13 inches. The effective rooting depth is limited by a seasonal high water table within a depth of 1.5 feet in winter and spring. This soil is occasionally flooded for brief periods in winter and spring. Runoff is slow, and the hazard of water erosion is slight.

This unit is used mainly for hay and pasture. It also provides habitat for many kinds of wildlife.

Hay and pasture.—If this unit is used for hay and pasture, the main limitation is the seasonal high water table. Wetness limits the choice of plants and the period of cutting or grazing and increases the risk of winterkill.

Grazing during wet periods results in compaction of the surface layer, poor tilth, and increased runoff. Conducting fieldwork during wet periods results in deterioration of tilth and destroys soil structure. As a result, it increases the runoff rate and the hazard of erosion. Compaction limits the movement of air and water in the soil and restricts the growth of roots.

Fertilizer is needed to ensure the optimum growth of grasses and legumes.

In summer irrigation is needed for the maximum production of hay. Controlled surface irrigation is a suitable method of applying water. Leveling helps to ensure the uniform application of water. To avoid 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.

Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and control erosion. Periodic mowing and clipping help to maintain uniform growth and prevent selective grazing.

Because of salt concentrations, the selection of trees and shrubs that can be grown as windbreaks and environmental plantings is limited and seedling mortality is severe. The species selected for planting should be those that can withstand excess moisture. Spring planting may be delayed because of the excess moisture.

The Baldock soil is in the Wet Meadow range site.

14D—Baldridge very gravelly loam, 12 to 35 percent south slopes. This deep, well drained soil is on mountains. It formed in colluvium derived from rhyolite and andesite. Areas are irregular in shape and are 80 to 200 acres in size. The native vegetation is mainly bunchgrasses, shrubs, and forbs. Elevation is 4,000 to 6,000 feet. The average annual precipitation is 16 to 20 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 60 to 90 days.

Typically, the surface layer is very dark brown very gravelly loam about 14 inches thick. The upper part of the subsoil is very dark grayish brown very gravelly loam about 16 inches thick. The lower part is dark grayish brown extremely cobbly loam about 17 inches thick. The substratum to a depth of 60 inches or more is light brownish gray extremely cobbly sandy loam.

Included in this unit are small areas of Segundo soils. Also included are small areas of Anatone and Stavely soils. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate in the Baldridge soil. Available water capacity is 3 to 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 mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on this unit is dominated by mountain big sagebrush, buckwheat, bluebunch wheatgrass, and needlegrass.

Bluebunch wheatgrass is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 1,600 pounds per acre in favorable years and 900 pounds per acre in unfavorable years.

If the condition of the site deteriorates through overgrazing, bluebunch wheatgrass loses vigor and decreases in extent. Blue wildrye, buckwheat, and mountain big sagebrush increase in extent. If deterioration continues, the extent of needlegrass and blue wildrye decreases and annual grasses and forbs invade the site.

The Baldridge soil is in the High Mountain Loam 18+pz range site.

14E—Baldridge very gravelly loam, 35 to 50 percent south slopes. This deep, well drained soil is on mountains. It formed in colluvium derived from rhyolite and andesite. Areas are irregular in shape and are 80 to 200 acres in size. The native vegetation is mainly bunchgrasses, shrubs, and forbs. Elevation is 4,000 to 6,000 feet. The average annual precipitation is 16 to 20 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 60 to 90 days.

Typically, the surface layer is very dark brown very gravelly loam about 14 inches thick. The upper part of the subsoil is very dark grayish brown very gravelly loam about 16 inches thick. The lower part is dark grayish brown extremely cobbly loam about 17 inches thick. The substratum to a depth of 60 inches or more is light brownish gray extremely cobbly sandy loam.

Included in this unit are small areas of Segundo soils. Also included are small areas of Anatone and Stavely soils. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate in the Baldridge soil. Available water capacity is 3 to 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 mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on this unit is dominated by mountain big sagebrush, buckwheat, bluebunch wheatgrass, and needlegrass.

Bluebunch wheatgrass is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 1,600 pounds per acre in favorable years and 900 pounds per acre in unfavorable years. Livestock access is limited by the slope.

If the condition of the site deteriorates through overgrazing, bluebunch wheatgrass loses vigor and decreases in extent. Blue wildrye, buckwheat, and mountain big sagebrush increase in extent. If deterioration continues, the extent of needlegrass and blue wildrye decreases and annual grasses and forbs invade the site.

Mechanical treatment for brush control or range seeding is not practical because of the slope.

The Baldridge soil is in the High Mountain South 16-20pz range site.

14F—Baldridge very gravelly loam, 50 to 70 percent south slopes. This deep, well drained soil is on mountains. It formed in colluvium derived from rhyolite and andesite. Areas are irregular in shape and are 80 to 200 acres in size. The native vegetation is mainly bunchgrasses, shrubs, and forbs. Elevation is 4,000 to 6,000 feet. The average annual precipitation is 16 to 20 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 60 to 90 days.

Typically, the surface layer is very dark brown very gravelly loam about 14 inches thick. The upper part of the subsoil is very dark grayish brown very gravelly loam about 16 inches thick. The lower part is dark grayish brown extremely cobbly loam about 17 inches thick. The substratum to a depth of 60 inches or more is light brownish gray extremely cobbly sandy loam.

Included in this unit are small areas of Segundo soils. Also included are small areas of Anatone and Stavely soils. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate in the Baldridge soil. Available water capacity is 3 to 8 inches. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is very high.

This unit is used mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on this unit is dominated by mountain big sagebrush, buckwheat, bluebunch wheatgrass, and needlegrass.

Bluebunch wheatgrass is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 1,600 pounds per acre in favorable years and 900 pounds per acre in unfavorable years. Livestock access is limited by the slope.

If the condition of the site deteriorates through overgrazing, bluebunch wheatgrass loses vigor and decreases in extent. Blue wildrye, buckwheat, and mountain big sagebrush increase in extent. If deterioration continues, the extent of needlegrass and blue wildrye decreases and annual forbs and grasses invade the site.

Mechanical treatment for brush control and range seeding is not practical because of the slope.

The Baldridge soil is in the High Mountain South 16-20pz range site.

15A—Balm loam, 0 to 3 percent slopes. This deep, somewhat poorly drained soil is on flood plains. It formed in stratified, mixed alluvium. Areas are elongated and are 20 to 150 acres in size. The native vegetation is mainly water-tolerant grasses and sedges. Elevation is 2,000 to 3,400 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 47 to 51 degrees F, and the average frost-free period is 120 to 140 days.

Typically, the surface layer is about 2 inches of very dark brown loam and 10 inches of very dark brown silt loam. The next layer is dark brown, mottled silt loam about 5 inches thick. The upper 13 inches of the substratum is dark olive gray, mottled silt loam and very dark gray fine sandy loam. The lower 30 inches is multicolored very gravelly sand. Depth to the contrasting substratum is 20 to 40 inches.

Included in this unit are small areas of Baldock, Boyce, Wingville, and Wingdale soils. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate to a depth of about 30 inches in the Balm soil and very rapid below that depth. Available water capacity is 4 to 7 inches. The effective rooting depth is limited by a seasonal high water table at a depth of 1 to 2 feet in winter and early summer. This soil is subject to rare flooding. Runoff is slow, and the hazard of water erosion is slight.

This unit is used mainly for hay and pasture. It also provides habitat for many kinds of wildlife.

Hay and pasture.—If this unit is used for hay and pasture, the main limitation is the seasonal high water table. Wetness limits the choice of plants and the period of cutting or grazing and increases the risk of winterkill.

Grazing during wet periods results in compaction of the surface layer, poor tilth, and excessive runoff. Conducting fieldwork during wet periods results in deterioration of tilth and destroys soil structure. As a result, it increases the runoff rate and the hazard of erosion. Compaction limits the movement of air and water in the soil and restricts the growth of roots.

Fertilizer is needed to ensure the optimum growth of grasses and legumes.

In summer irrigation is needed for the maximum production of hay. Controlled surface irrigation is a suitable method of applying water. Leveling helps to ensure the uniform application of water. To avoid 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.

Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and control erosion. Periodic mowing and clipping help to maintain uniform growth and prevent selective grazing.

This soil is generally unsuited to the trees and shrubs grown as windbreaks and environmental plantings. Onsite investigation is needed to identify areas where trees and shrubs can be planted if special management is applied.

The Balm soil is in the Meadow range site.

16B—Barnard silt loam, 2 to 7 percent slopes. This well drained soil is on terraces. It is moderately deep to a duripan. It formed in alluvial sediments influenced by volcanic ash in the surface layer. Areas are irregular in shape and are 100 to 400 acres in size. The native vegetation is mainly bunchgrasses, forbs, and shrubs. Elevation is 2,300 to 3,500 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 47 to 51 degrees F, and the average frost-free period is 100 to 140 days.

Typically, the surface layer is very dark grayish brown silt loam about 7 inches thick. The next layer is dark brown silty clay loam about 7 inches thick. The upper part of the subsoil is dark brown silty clay about 8 inches thick. The lower part is a silica-cemented duripan about 8 inches thick. The substratum to a depth of 60 inches or more is pale brown very gravelly loam. The depth to a duripan is 20 to 40 inches.

Included in this unit are small areas of Barnard cobbly silt loam. Also included are small areas of Baker and Ruckles soils. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate to a depth of about 14 inches in the Barnard soil and slow between that depth and the impermeable duripan. It is rapid in the substratum. Available water capacity is 3 to 6 inches. The effective rooting depth is 20 to 40 inches. Runoff is slow, and the hazard of water erosion is slight or moderate.

This unit is used mainly for irrigated hay and pasture or small grain. It also is used for homesite development, and it provides habitat for many kinds of wildlife.

Hay and pasture or cropland.—If this unit is used as hayland, pasture, or cropland, the main limitation is the rooting depth. Ripping and shattering the duripan increase the effective rooting depth and improve internal drainage.

Management that maintains the optimum vigor and quality of forage plants is needed. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and control erosion. Periodic mowing and clipping help to maintain uniform growth and prevent selective grazing.

In summer irrigation is needed for maximum crop production. Sprinkler irrigation is a suitable method of applying water. It permits the even, controlled application of water, helps to control runoff, and minimizes the risk of erosion. To avoid 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.

Fertilizer is needed to ensure the optimum growth of grasses, legumes, and other crops. 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.

Conducting fieldwork during wet periods results in deterioration of tilth and destroys soil structure. As a result, it increases the runoff rate and the hazard of erosion. Runoff and erosion can be controlled by crop residue management and by rough or minimum tillage. All tillage should be on the contour or across the slope.

Grazing during wet periods results in compaction of the surface layer, poor tilth, and excessive runoff. Compaction limits the movement of air and water in the soil and restricts the growth of roots.

A wide variety of trees and shrubs can be grown as windbreaks and environmental plantings on this soil. Seedling mortality is severe because the high content of clay causes moisture stress in the seedlings. Cultivation or applications of herbicide help to remove competing vegetation.

Homesite development.—If this unit is used for homesite development, the main limitations are the depth to a duripan, a moderate potential for frost action, the slow permeability in the clayey subsoil, a moderate shrink-swell potential, and the slope.

This soil is poorly suited to septic tank absorption fields because of the depth to a duripan and the slow permeability. Properly designing buildings helps to prevent the structural damage caused by shrinking and swelling and by frost action. Properly designing roads helps to offset the moderate potential for frost action. In the steeper areas the hazard of erosion can be reduced by disturbing only the part of the site that is used for construction.

The Barnard soil is in the Loamy 9-12pz range site.

16C—Barnard silt loam, 7 to 12 percent slopes. This well drained soil is on terraces. It is moderately deep to a duripan. It formed in alluvial sediments influenced by volcanic ash in the surface layer. Areas are irregular in shape and are 100 to 400 acres in size. The vegetation in areas that have not been cultivated is mainly bunchgrasses, forbs, and shrubs. Elevation is 2,300 to 3,500 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 47 to 51 degrees F, and the average frost-free period is 100 to 140 days.

Typically, the surface layer is very dark grayish brown silt loam about 7 inches thick. The next layer is dark brown silty clay loam about 7 inches thick. The upper part of the subsoil is dark brown silty clay about 8 inches thick. The lower part is a silica-cemented duripan about 8 inches thick. The substratum to a depth of 60 inches or more is pale brown very gravelly loam. The depth to a duripan is 20 to 40 inches.

Included in this unit are small areas of Barnard cobbly silt loam. Also included are small areas of Baker and Ruckles soils. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate to a depth of about 14 inches in the Barnard soil and slow between that depth and the impermeable duripan. It is rapid in the substratum. Available water capacity is 3 to 6 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 irrigated hay and pasture. It also is used for small grain or homesite development, and it provides habitat for many kinds of wildlife.

Hay and pasture or cropland.—If this unit is used as hayland, pasture, or cropland, the main limitation is the rooting depth. Ripping and shattering the duripan increase the effective rooting depth and improve internal drainage.

Management that maintains the optimum vigor and quality of forage plants is needed. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and control erosion. Periodic mowing and clipping help to maintain uniform growth and prevent selective grazing.

In summer irrigation is needed for maximum crop production. Sprinkler irrigation is a suitable method of applying water. It permits the even, controlled application of water, helps to control runoff, and minimizes the risk of erosion. To avoid 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.

Fertilizer is needed to ensure the optimum growth of grasses, legumes, and other crops. 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.

Conducting fieldwork during wet periods results in deterioration of tilth and destroys soil structure. As a result, it increases the runoff rate and the hazard of erosion. Runoff and erosion can be controlled by crop residue management and by rough or minimum tillage. All tillage should be on the contour or across the slope.

Grazing during wet periods results in compaction of the surface layer, poor tilth, and excessive runoff. Compaction limits the movement of air and water in the soil and restricts the growth of roots.

A wide variety of trees and shrubs can be grown as windbreaks and environmental plantings on this soil. Seedling mortality is severe because the high content of clay causes moisture stress in the seedlings. Cultivation or applications of herbicide help to remove competing vegetation.

Homesite development.—If this unit is used for homesite development, the main limitations are the depth to a duripan, a moderate potential for frost action, the slow permeability in the clayey subsoil, the slope, and a moderate shrink-swell potential.

This soil is poorly suited to septic tank absorption fields because of the depth to a duripan and the slow permeability. Properly designing buildings helps to prevent the structural damage caused by shrinking and swelling and by frost action. Properly designing roads helps to offset the moderate potential for frost action and can help to control runoff and stabilize cut slopes. In the steeper areas the hazard of erosion can be reduced by disturbing only the part of the site that is used for construction.

The Barnard soil is in the Loamy 9-12pz range site.

16D—Barnard silt loam, 12 to 20 percent slopes. This well drained soil is on terraces. It is moderately deep to a duripan. It formed in alluvial sediments influenced by volcanic ash in the surface layer. Areas are irregular in shape and are 100 to 400 acres in size. The native vegetation is mainly bunchgrasses, forbs, and shrubs. Elevation is 2,300 to 3,500 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 47 to 51 degrees F, and the average frost-free period is 100 to 140 days.

Typically, the surface layer is very dark grayish brown silt loam about 7 inches thick. The next layer is dark brown silty clay loam about 7 inches thick. The upper part of the subsoil is dark brown silty clay about 8 inches thick. The lower part is a silica-cemented duripan about 8 inches thick. The substratum to a depth of about 60 inches is pale brown very gravelly loam. The depth to a duripan is 20 to 40 inches.

Included in this unit are small areas of Barnard cobbly silt loam. Also included are small areas of Ruckles and Hyall soils. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate to a depth of about 14 inches in the Barnard soil and slow between that depth and the impermeable duripan. It is rapid in the substratum. Available water capacity is 3 to 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 mainly for irrigated hay and pasture. It also provides habitat for many kinds of wildlife.

Hay and pasture.—If this unit is used for hay and pasture, the main limitations are the rooting depth and the slope. Ripping and shattering the duripan increase the effective rooting depth and improve internal drainage.

Management that maintains the optimum vigor and qualilty of forage plants is needed. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and control erosion. Periodic mowing and clipping help to maintain uniform growth and prevent selective grazing. All tillage should be on the contour or across the slope.

In summer irrigation is needed for the maximum production of forage. Sprinkler irrigation is a suitable method of applying water. It permits the even, controlled application of water, helps to control runoff, and minimizes the risk of erosion. To avoid 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.

Fertilizer is needed to ensure the optimum growth of grasses and legumes.

A wide variety of trees and shrubs can be grown as windbreaks and environmental plantings on this soil. Seedling mortality is severe because the high content of clay causes moisture stress in the seedlings. Cultivation or applications of herbicide help to remove competing vegetation.

Grazing during wet periods results in compaction of the surface layer, poor tilth, and excessive runoff. Compaction limits the movement of air and water in the soil and restricts the growth of roots.

The Barnard soil is in the Clayey South 9-12pz range site.

17C—Barnard cobbly silt loam, 7 to 20 percent slopes. This well drained soil is on the side slopes of terraces. It is moderately deep to a duripan. It formed in lacustrine and alluvial sediments. Areas are irregular in shape and are 100 to 400 acres in size. The native vegetation is mainly bunchgrasses, forbs, and shrubs. Elevation is 2,300 to 3,000 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 47 to 51 degrees F, and the average frost-free period is 100 to 140 days.

Typically, the surface layer is very dark grayish brown cobbly silt loam about 9 inches thick. The next layer is dark brown cobbly silty clay loam about 8 inches thick. The upper part of the subsoil is dark brown silty clay about 15 inches thick. The lower part is a silica-cemented duripan about 15 inches thick. The substratum to a depth of about 60 inches is very pale brown very gravelly loam. The depth to a duripan is 20 to 40 inches.

Included in this unit are small areas of Barnard silt loam. Also included are small areas of Ruckles and Ruclick soils. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate to a depth of about 17 inches in the Barnard soil and slow between that depth and the impermeable duripan. It is rapid in the substratum. Available water capacity is 3 to 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 mainly for irrigated pasture. It also is used for livestock grazing, and it provides habitat for many kinds of wildlife.

Pasture.—If this unit is used for pasture, the main limitations are the cobbles on the surface, the rooting depth, and the slope. The cobbles may limit some fieldwork. Ripping and shattering the duripan increase the effective rooting depth and improve internal drainage.

Management that maintains the optimum vigor and quality of forage plants is needed. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and control erosion. Periodic mowing and clipping help to maintain uniform growth and prevent selective grazing. All tillage should be on the contour or across the slope.

In summer irrigation is needed for maximum crop production. Sprinkler irrigation is a suitable method of applying water. It permits the even, controlled application of water, helps to control runoff, and minimizes the risk of erosion. To avoid 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.

Fertilizer is needed to ensure the optimum growth of grasses and legumes.

Grazing during wet periods results in compaction of the surface layer, poor tilth, and excessive runoff. Compaction limits the movement of air and water in the soil and restricts the growth of roots.

A wide variety of trees and shrubs can be grown as windbreaks and environmental plantings on this soil. Seedling mortality is severe because the high content of clay causes moisture stress in the seedlings. Cultivation or applications of herbicide help to remove competing vegetation.

Livestock grazing.—The potential plant community on this unit is dominated by bluebunch wheatgrass and Wyoming big sagebrush.

Bluebunch wheatgrass is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 1,200 pounds per acre in favorable years and 400 pounds per acre in unfavorable years.

If the condition of the site deteriorates through overgrazing, bluebunch wheatgrass loses vigor and decreases in extent. Sandberg bluegrass, Wyoming big sagebrush, and perennial forbs increase in extent. If deterioration continues, unpalatable annual grasses and forbs invade the site.

The Barnard soil is in the Clayey South 9-12pz range site.

18B—Benderly gravelly fine sandy loam, 0 to 7 percent slopes. This deep, somewhat excessively drained soil is on alluvial fans. It formed in mixed alluvium. Areas are irregular in shape and are 10 to 100 acres in size. The native vegetation is mainly bunchgrasses, forbs, and shrubs. Elevation is 3,400 to 3,800 feet. The average annual precipitation is 12 to 16 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 130 days.

Typically, the surface layer is very dark grayish brown and dark brown gravelly fine sandy loam about 16 inches thick. The substratum is extremely gravelly sand. The upper 5 inches is dark brown, and the lower 39 inches is brown. Depth to the extremely gravelly substratum is 10 to 20 inches.

Included in this unit are small areas of Goodrich soils. Also included are small areas of soils that are similar to the Benderly soil but have a very cobbly surface or are less than 10 inches deep to the extremely gravelly substratum. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderately rapid to a depth of about 16 inches in the Benderly soil and very rapid below that depth. Available water capacity is 2 to 4 inches. The effective rooting depth is limited by the extremely gravelly substratum at a depth of 10 to 20 inches. Runoff is slow, and the hazard of water erosion is slight or moderate.

This unit is used mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on this unit is dominated by Idaho fescue, mountain big sagebrush, and squaw apple.

Idaho fescue is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 1,800 pounds per acre in favorable years and 1,000 pounds per acre in unfavorable years.

If the condition of the site deteriorates through overgrazing, Idaho fescue loses vigor and decreases in extent. Needlegrass, threadleaf sedge, mountain big sagebrush, basin big sagebrush, and Sandberg bluegrass increase in extent. If deterioration continues, the extent of bluebunch wheatgrass, needlegrass, and threadleaf sedge decreases, the extent of mountain big sagebrush strongly increases, and unpalatable forbs and annuals invade the site.

Livestock watering ponds are not suitable because of the hazard of seepage.

The Benderly soil is in the Mountain Loamy 12-16pz range site.

19E—Boiler gravelly loam, 35 to 60 percent north slopes. This deep, well drained soil is on mountains. It formed in colluvium derived from tuffaceous sediments. Areas are irregular in shape and are 80 to 200 acres in size. The native vegetation is mainly conifers, shrubs, bunchgrasses, and forbs. Elevation is 4,000 to 5,000 feet. The average annual precipitation is 16 to 30 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 30 to 50 days.

Typically, the surface is covered with a mat of partially decomposed needles, leaves, and twigs about 1 inch thick. The surface layer is very dark grayish brown gravelly loam about 6 inches thick. The next layer is dark brown very gravelly clay loam about 7 inches thick. The subsoil is about 36 inches of brown and dark yellowish brown extremely gravelly silty clay and clay. The depth to weathered sediments is 40 to more than 60 inches.

Included in this unit are small areas of Hankins soils and Rock outcrop. Also included are small areas of soils that are similar to the Boiler soil but are less than 40 inches deep over bedrock. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is slow in the Boiler soil. Available water capacity is 3 to 6 inches. The effective rooting depth is 40 to 60 inches. Runoff is rapid, and the hazard of water erosion is high or very high.

This unit is used mainly for timber production. It also is used for livestock grazing, and it provides habitat for many kinds of wildlife.

Woodland.—This unit is suited to the production of ponderosa pine and Douglas-fir. The mean site index is 58 for ponderosa pine (100-year base age) and 53 for Douglas-fir (50-year base age). The potential production at culmination of the mean annual increment for ponderosa pine is 44 cubic feet per acre per year (3.1 cubic meters per hectare per year) in a 60-year-old, even-aged, fully stocked stand and for Douglas-fir is 34 cubic feet per acre per year (2.4 cubic meters per hectare per year) in a 114-year-old, even-aged, fully stocked stand.

The main concerns in producing and harvesting timber are the hazard of erosion, the equipment limitation, seedling mortality, the hazard of windthrow, plant competition, and fire damage to the soil.

Minimizing the risk of erosion is essential in areas where timber is harvested. Properly designed road drainage systems that include carefully located culverts help to control erosion. Spoil from excavations is subject to rill and gully erosion and to sloughing. Roads, landings, skid trails, and firebreaks can be protected against erosion by constructing water bars and by seeding areas that have been cut and filled. Buffer strips may be needed in areas adjacent to perennial streams to minimize siltation and maintain stream temperatures.

The slope restricts the use of wheeled and tracked equipment on skid trails. High-lead or other logging systems that fully or partially suspend the logs above the ground will damage the soil less than tractor systems and reduce the risk of compaction. The risk of compaction also can be reduced by using suitable harvesting methods, laying out skid trails in advance, and harvesting timber when the soil is dry or frozen.

Careful management of reforestation is needed to minimize competition from undesirable plants. If the site is not adequately prepared, plant competition can prevent or delay reestablishment of volunteer or planted trees. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying. Scarification is severely restricted in the steeper areas because of increased expense and soil displacement. The trees that are suitable for planting include ponderosa pine and Douglas-fir. The seedling survival rate is only moderate because of the droughtiness caused by rock fragments.

Trees are subject to windthrow because of the restricted rooting depth. They are particularly susceptible during periods when the soil is excessively wet and winds are strong. Regeneration systems that isolate single trees or groups of trees are not practical because of the hazard of windthrow.

Some decline in forest productivity may result from fire of moderate intensity.

Grazable woodland.—This unit is suitable for use as grazable woodland. The understory consists mainly of common snowberry, spirea, elk sedge, pinegrass, Idaho fescue, and strawberry. The potential production of the native understory plants in a normal year is about 800 pounds of air-dry forage per acre.

A system that results in proper grazing use is essential if livestock graze this unit. Timely deferment of grazing is needed to allow the desirable plants to mature and set seed. Because of steep, unstable slopes, grazing should be delayed in spring until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.

Seeding disturbed areas to suitable plants reduces the hazard of erosion and provides forage for livestock and wildlife. Deferred grazing is needed during periods when seedlings are becoming established.

This soil can produce adequate forage for big game animals after the tree canopy is opened by logging, fire, or some other disturbance. Stands of timber should be left in some areas to provide escape and thermal cover for the big game animals.

The Boiler soil is in the Pine-Snowberry-Sedge woodland understory site.

20D—Bouldrock loam, 12 to 35 percent south slopes. This moderately deep, well drained soil is on hills. It formed in residuum and colluvium derived from quartz diorite and related granitic rocks. Areas are irregular in shape and are 40 to 200 acres in size. The native vegetation is mainly bunchgrasses, shrubs, and forbs. Elevation is 4,000 to 6,200 feet. The average annual precipitation is 16 to 20 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 70 to 100 days.

Typically, the surface layer is black loam about 6 inches thick. The subsoil is very dark brown and very dark grayish brown sandy loam about 15 inches thick. The substratum is dark brown sandy loam. It extends to a depth of about 32 inches. The depth to weathered granitic bedrock is 20 to 40 inches.

Included in this unit are small areas of Bouldrock very bouldery loam and Kilmerque soils. Also included are small areas of soils that are similar to the Bouldrock soil but are less than 20 inches deep over bedrock. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate to a depth of about 6 inches in the Bouldrock soil and moderately rapid below that depth. Available water capacity is 2 to 5 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 mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on this unit is dominated by bluebunch wheatgrass, mountain big sagebrush, and buckwheat.

Bluebunch wheatgrass is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 1,600 pounds per acre in favorable years and 900 pounds per acre in unfavorable years.

If the condition of the site deteriorates through overgrazing, bluebunch wheatgrass loses vigor and decreases in extent. Mountain big sagebrush, buckwheat, and blue wildrye increase in extent. If deterioration continues, the extent of needlegrass and blue wildrye decreases and annual grasses and forbs invade the site.

The Bouldrock soil is in the High Mountain South 16-20pz range site.

21E—Bouldrock complex, 35 to 60 percent south slopes. This map unit is on hills. Areas are irregular in shape and are 40 to 200 acres in size. The native vegetation is mainly bunchgrasses, shrubs, and forbs. Elevation is 4,000 to 6,200 feet. The average annual precipitation is 16 to 20 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 80 to 100 days.

This unit is about 50 percent Bouldrock loam and 35 percent Bouldrock very bouldery loam. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of Kilmerque soils and Rock outcrop. Also included are small areas of soils that are similar to the Bouldrock soils but are less than 20 inches deep over bedrock. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Bouldrock loam is moderately deep and well drained. It formed in residuum and colluvium derived from quartz diorite and related granitic rocks. Typically, the surface layer is black loam about 6 inches thick. The subsoil is very dark brown and very dark grayish brown sandy loam about 15 inches thick. The substatum is dark brown sandy loam. It extends to a depth of about 32 inches. The depth to weathered granitic bedrock is 20 to 40 inches.

Bouldrock very bouldery loam is moderately deep and well drained. It formed in residuum and colluvium derived from quartz diorite and related granitic rocks. Typically, the surface layer is black very bouldery loam about 9 inches thick. The subsoil is very dark brown sandy loam about 16 inches thick. The substratum is dark brown gravelly sandy loam. It extends to a depth of about 29 inches. The depth to weathered granitic bedrock is 20 to 40 inches.

Permeability is moderate to a depth of about 9 inches in the Bouldrock soils and moderately rapid below that depth. Available water capacity is 2 to 5 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high or very high.

This unit is used mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on this unit is dominated by bluebunch wheatgrass, mountain big sagebrush, and buckwheat.

Bluebunch wheatgrass is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 1,600 pounds per acre in favorable years and 900 pounds per acre in unfavorable years. Livestock access is somewhat limited by the slope and the boulders on the surface.

If the condition of the site deteriorates through overgrazing, bluebunch wheatgrass loses vigor and decreases in extent. Mountain big sagebrush, buckwheat, and blue wildrye increase in extent. If deterioration continues, the extent of blue wildrye decreases and annual grasses and forbs invade the site.

Mechanical treatment for brush control and range seeding is not practical because of the slope and the boulders on the surface.

The Bouldrock soils are in the High Mountain South 16-20pz range site.

22E—Bouldrock-Kilmerque complex, 35 to 60 percent south slopes. This map unit is on mountains. Areas are irregular in shape and are 40 to 400 acres in size. The native vegetation is mainly conifers, shrubs, bunchgrasses, and forbs. Elevation is 4,000 to 6,200 feet. The average annual precipitation is 16 to 20 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 80 to 100 days.

This unit is about 50 percent Bouldrock very bouldery loam and 35 percent Kilmerque loam. The Bouldrock soil is used as rangeland, and the Kilmerque soil is used as woodland. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of Bouldrock soils that have a surface layer of loam and small areas of Rock outcrop. Also included are small areas of soils that are similar to the Kilmerque soil but are more than 40 inches deep over bedrock. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Bouldrock soil is moderately deep and well drained. It formed in residuum and colluvium derived from quartz diorite and related granitic rocks. Typically, the surface layer is black very bouldery loam about 9 inches thick. The substratum is dark brown gravelly sandy loam. It extends to a depth of about 29 inches. The depth to weathered granitic bedrock is 20 to 40 inches.

Permeability is moderate to a depth of about 9 inches in the Bouldrock soil and moderately rapid below that depth. Available water capacity is 2 to 5 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high or very high.

The Kilmerque soil is moderately deep and well drained. It formed in colluvium and residuum derived from quartz diorite. Typically, the surface is covered with a mat of partially decomposed needles, leaves, and twigs about 0.5 inch thick. The surface layer is very dark grayish brown loam about 5 inches thick. The upper part of the subsoil is dark brown loam about 7 inches thick. The lower part is dark yellowish brown sandy loam about 4 inches thick. The substratum is yellowish brown gravelly coarse sandy loam about 10 inches thick. The depth to weathered bedrock is 20 to 40 inches.

Permeability is moderate to a depth of about 16 inches in the Kilmerque soil and moderately rapid below that depth. Available water capacity is 2 to 5 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high or very high.

This unit is used mainly for timber production and livestock grazing. It also provides habitat for many kinds of wildlife.

Woodland.—The Kilmerque soil is suited to the production of ponderosa pine and Douglas-fir. The mean site index is 82 for ponderosa pine (100-year base age) and 66 for Douglas-fir (50-year base age). The potential production at culmination of the mean annual increment for ponderosa pine is 72 cubic feet per acre per year (5.0 cubic meters per hectare per year) in a 40-year-old, even-aged, fully stocked stand.

The main concerns in producing and harvesting timber on this unit are the hazard of erosion, the equipment limitation, seedling mortality, the hazard of windthrow, plant competition, and fire damage to the soil.

Minimizing the risk of erosion is essential in areas where timber is harvested. Properly designed road drainage systems that include carefully located culverts help to control erosion. Spoil from excavations is subject to rill and gully erosion and to sloughing. Roads and landings can be protected against erosion by constructing water bars and by seeding areas that have been cut and filled. Buffer strips may be needed in areas adjacent to perennial streams to minimize siltation and maintain stream temperatures.

The slope restricts the use of wheeled and tracked equipment on skid trails. High-lead or other logging systems that fully or partially suspend the logs above the ground will damage the soil less than tractor systems and reduce the risk of compaction. The risk of compaction also can be reduced by using suitable harvesting methods, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction.

Careful management of reforestation is needed to minimize competition from undesirable plants. If the site is not adequately prepared, plant competition can prevent or delay reestablishment of volunteer or planted trees. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying. Scarification is severely restricted in the steeper areas because of increased expense and soil displacement.

The seedling mortality rate is increased by compaction of the surface layer and by droughtiness in the surface layer, especially on south- and southwest-facing slopes. Shading and mulching of seedlings may be required. The trees that are suitable for planting include ponderosa pine and Douglas-fir.

Trees commonly are subject to windthrow during periods when the soil is excessively wet and winds are strong. Regeneration systems that isolate single trees or groups of trees are not practical because of the hazard of windthrow.

Some decline in forest productivity may result from fire of moderate intensity.

Grazable woodland.—The Kilmerque soil is suitable for use as grazable woodland. The understory vegetation consists mainly of common snowberry, spirea, elk sedge, pinegrass, strawberry, and low Oregongrape. The potential production of the native understory plants in a normal year is about 800 pounds of air-dry forage per acre.

This soil can produce adequate forage for big game animals after the tree canopy is opened by logging, fire, or some other disturbance. Dense stands of timber should be left in some areas to provide escape and thermal cover for the big game animals.

Livestock grazing.—The potential plant community on the Bouldrock soil is dominated by bluebunch wheatgrass, mountain big sagebrush, and buckwheat.

Bluebunch wheatgrass is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 1,600 pounds per acre in favorable years and 900 pounds per acre in unfavorable years. Livestock access is limited by the Rock outcrop, the slope, and the boulders on the surface.

If the condition of the site deteriorates through overgrazing, bluebunch wheatgrass loses vigor and decreases in extent. Mountain big sagebrush, buckwheat, and blue wildrye increase in extent. If deterioration continues, the extent of blue wildrye decreases and annual grasses and forbs invade the site.

Mechanical treatment for brush control and range seeding is not practical because of the slope and the boulders on the surface.

The Bouldrock soil is in the High Mountain South 16-20pz range site. The Kilmerque soil is in the Pine-Fir-Sedge woodland understory site.

22F—Bouldrock-Kilmerque complex, 60 to 80 percent south slopes. This map unit is on mountains. Areas are irregular in shape and are 40 to 400 acres in size. The native vegetation is mainly conifers, shrubs, bunchgrasses, and forbs. Elevation is 4,000 to 6,200 feet. The average annual precipitation is 16 to 20 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 80 to 100 days.

This unit is about 50 percent Bouldrock very bouldery loam and 35 percent Kilmerque loam. The Bouldrock soil is used as rangeland, and the Kilmerque soil is used as woodland. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of Rock outcrop and Bouldrock loam. Also included are small areas of soils that are similar to the Bouldrock soil but are less than 20 inches deep over bedrock and soils that are similar to the Kilmerque soil but are more than 40 inches deep over bedrock. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Bouldrock soil is moderately deep and well drained. It formed in residuum and colluvium derived from quartz diorite and related granitic rocks. Typically, the surface layer is black very bouldery loam about 9 inches thick. The subsoil is very dark brown sandy loam about 16 inches thick. The substratum is dark brown gravelly sandy loam. It extends to a depth of about 29 inches. The depth to granitic bedrock is 20 to 40 inches.

Permeability is moderate to a depth of about 9 inches in the Bouldrock soil and moderately rapid below that depth. Available water capacity is 2 to 5 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is very high.

The Kilmerque soil is moderately deep and well drained. It formed in colluvium and residuum derived from quartz diorite and related granitic rocks. Typically, the surface is covered with a mat of partially decomposed needles, leaves, and twigs about 0.5 inch thick. The surface layer is very dark grayish brown loam about 5 inches thick. The upper part of the subsoil is dark brown loam about 7 inches thick. The lower part is dark yellowish brown sandy loam about 4 inches thick. The substratum is yellowish brown gravelly coarse sandy loam about 10 inches thick. The depth to bedrock is 20 to 40 inches.

Permeability is moderate to a depth of about 16 inches in the Kilmerque soil and moderately rapid below that depth. Available water capacity is 2 to 5 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is very high.

This unit is used mainly for timber production. It also is used for livestock grazing, and it provides habitat for many kinds of wildlife.

Woodland.—The Kilmerque soil is suited to the production of ponderosa pine and Douglas-fir. The mean site index is 82 for ponderosa pine (100-year base age) and 66 for Dougles fir (50-year base age). The potential production at culmination of the mean annual increment for ponderosa pine is 72 cubic feet per acre per year (5.0 cubic meters per hectare per year) in a 40-year-old, even-aged, fully stocked stand and for Douglas-fir is 54 cubic feet per acre per year (3.8 cubic meters per hectare per year) in a 106-year-old, even-aged, fully stocked stand.

The main concerns in producing and harvesting timber on this unit are the hazard of erosion, the equipment limitation, seedling mortality, the hazard of windthrow, plant competition, and fire damage to the soil.

Minimizing the risk of erosion is essential in areas where timber is harvested. Properly designed road drainage systems that include carefully located culverts help to control erosion. Spoil from excavations is subject to rill and gully erosion and to sloughing. Roads and landings can be protected against erosion by constructing water bars and by seeding areas that have been cut and filled. Buffer strips may be needed in areas adjacent to perennial streams to minimize siltation and maintain stream temperatures.

The slope prevents the use of wheeled and tracked equipment. High-lead or other logging systems that fully suspend the logs above the ground will damage the soil less than other systems. The risk of compaction can be reduced by using suitable harvesting methods and by harvesting when the soil is least susceptible to compaction.

Careful management of reforestation is needed to minimize competition from undesirable plants. If the site is not adequately prepared, plant competition can prevent or delay reestablishment of volunteer or planted trees. Competing weeds, brush, or trees can be controlled by spraying, cutting, or girdling.

The seedling mortality rate is increased by compaction of the surface layer and by droughtiness in the surface layer, especially on south- and southwest-facing slopes. Shading and mulching of seedlings may be required. The trees that are suitable for planting include ponderosa pine and Douglas-fir.

Trees are subject to windthrow during periods when the soil is excessively wet and winds are strong. Regeneration systems that isolate single trees or groups of trees are not practical because of the hazard of windthrow.

Some decline in forest productivity may result from fire of moderate intensity.

The understory consists mainly of common snowberry, spirea, elk sedge, pinegrass, low Oregongrape, and strawberry.

This soil can produce adequate forage for big game animals after the tree canopy is opened by logging, fire, or some other disturbance. Dense stands of timber should be left in some areas to provide escape and thermal cover for the big game animals.

Livestock grazing.—The potential plant community on the Bouldrock soil is dominated by bluebunch wheatgrass, mountain big sagebrush, and buckwheat.

Bluebunch wheatgrass is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 1,600 pounds per acre in favorable years and 900 pounds per acre in unfavorable years. Livestock access is limited by the Rock outcrop, the slope, and the boulders on the surface.

If the condition of the site deteriorates through overgrazing, bluebunch wheatgrass loses vigor and decreases in extent. Blue wildrye, buckwheat, and mountain big sagebrush increase in extent. If deterioration continues, the extent of blue wildrye decreases and annual grasses and forbs invade the site.

Mechanical treatment for range seeding and brush control is not practical because of the slope and the boulders on the surface.

The Bouldrock soil is in the High Mountain South 16-20pz range site. The Kilmerque soil is in the Pine-Fir-Sedge woodland understory site.

23A—Boyce silt loam, 0 to 2 percent slopes. This deep, poorly drained soil is on flood plains. It formed in stratified, mixed alluvium. Areas are irregular in shape and are 10 to 50 acres in size. The native vegetation is mainly water-tolerant grasses, sedges, and rushes. Elevation is 2,000 to 3,600 feet. The average annual precipitation is 10 to 12 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 120 to 140 days.

Typically, the surface layer is very dark grayish brown silt loam about 4 inches thick. The next layer is very dark grayish brown, mottled silt loam about 25 inches thick. The upper 8 inches of the substratum is dark brown, mottled gravelly loamy sand. The lower part to a depth of 60 inches or more is multicolored very gravelly sand. Depth to the contrasting substratum is 20 to 40 inches.

Included in this unit are small areas of Balm soils. Also included are small areas of Cumulic Haploxerolls. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate to a depth of about 29 inches in the Boyce soil and rapid below that depth. Available water capacity is 6 to 8 inches. The effective rooting depth is limited by a seasonal high water table at a depth of 0.5 foot to 2.0 feet in spring and early summer. Runoff is slow, and the hazard of water erosion is slight.

This unit is used mainly for pasture. It also is used for hay production, and it provides habitat for many kinds of wildlife.

Hay and pasture.—If this unit is used for hay and pasture, the main limitation is the seasonal high water table. Wetness limits the choice of plants and the period of cutting or grazing and increases the risk of winterkill.

Grazing during wet periods results in compaction of the surface layer, poor tilth, and excessive runoff. Conducting fieldwork during wet periods results in deterioration of tilth and destroys soil structure. As a result, it increases the runoff rate and the hazard of erosion. Compaction limits the movement of air and water in the soil and restricts the growth of roots.

Fertilizer is needed to ensure the optimum growth of grasses and legumes.

In summer irrigation is needed for the maximum production of hay. Controlled surface irrigation is a suitable method of applying water. To avoid 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.

Management that maintains the optimum vigor and quality of forage plants is needed. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and control erosion. Periodic mowing and clipping help to maintain uniform growth and prevent selective grazing.

This soil is generally unsuited to the trees and shrubs grown as windbreaks and environmental plantings. Onsite investigation is needed to identify areas where trees and shrubs can be planted if special management is applied.

The Boyce soil is in the Wet Meadow range site.

24D—Brannan channery silt loam, 2 to 35 percent north slopes. This deep, well drained soil is on mountains. It formed in colluvium derived from schist and influenced by volcanic ash in the surface layer. Areas are irregular in shape and are 80 to 400 acres in size. The native vegetation is mainly conifers, shrubs, and forbs. Elevation is 4,000 to 6,000 feet. The average annual precipitation is 20 to 35 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 30 to 60 days.

Typically, the surface is covered with a mat of partially decomposed needles, twigs, and grasses about 1 inch thick. The surface layer is very dark grayish brown channery silt loam about 4 inches thick. The upper part of the subsoil is dark yellowish brown channery silt loam about 10 inches thick. The lower part is brown very channery sandy clay loam about 14 inches thick. The substratum is brown very channery sandy clay loam. It extends to a depth of about 48 inches. The mantle of volcanic ash is 14 to 20 inches thick.

Included in this unit are small areas of Inkler soils. Also included are small areas of Crackler and Rouen soils. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate in the Brannan soil. Available water capacity is 4 to 7 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. It also is used for livestock grazing, and it provides habitat for many kinds of wildlife.

Woodland.—This unit is suited to the production of Douglas-fir and grand fir. The mean site index is 50 for Douglas-fir (50-year base age) and 63 for grand fir (50-year base age). The potential production at culmination of the mean annual increment for Douglas-fir is 29 cubic feet per acre per year (2.0 cubic meters per hectare per year) in a 116-year-old, even-aged, fully stocked stand and for grand fir is 81 cubic feet per acre per year (5.7 cubic meters per hectare per year) in a 118-year-old, even-aged, fully stocked stand.

The main concerns in producing and harvesting timber are the hazard of erosion, the equipment limitation, seedling mortality, and plant competition.

Minimizing the risk of erosion is essential in areas where timber is harvested. Properly designed road drainage systems that include carefully located culverts help to control erosion. Spoil from excavations is subject to rill and gully erosion and to sloughing. Roads, landings, skid trails, and firebreaks can be protected against erosion by constructing water bars and by seeding areas that have been cut and filled. Buffer strips may be needed in areas adjacent to perennial streams to minimize siltation and maintain stream temperatures.

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. The risk of compaction can be reduced by using low-pressure ground equipment, laying out skid trails in advance, and harvesting timber when the soil is dry or frozen. Cable yarding systems that partially or fully suspend logs generally do less damage to the soil than conventional ground-based systems.

Careful management of reforestation is needed to minimize competition from undesirable plants. If the site is not adequately prepared, plant competition can prevent or delay reestablishment of volunteer or planted trees. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying.

The seedling mortality rate is increased by compaction of the surface layer because compaction limits the movement of water and air in the soil and restricts the growth of roots. The high content of rock fragments also limits seedling survival. To compensate for the higher expected mortality rate, larger seedlings or a greater number of seedlings than is typical can be planted. The trees that are suitable for planting include Douglas-fir, western larch, and grand fir.

Grazable woodland.—This unit is suitable for use as grazable woodland. The understory consists mainly of princes pine, myrtle pachystima, elk sedge, heartleaf arnica, pyrola, and western rattlesnake plantain.

A system that results in proper grazing use is essential if livestock graze this unit. Timely deferment of grazing is needed to allow the desirable plants to mature and set seed. Grazing should be delayed in spring until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.

Seeding disturbed areas to suitable plants reduces the hazard of erosion and provides forage for livestock and wildlife. Deferred grazing is needed during periods when seedlings are becoming established.

This soil can produce adequate forage for big game animals after the tree canopy is opened by logging, fire, or some other disturbance. Dense stands of timber should be left in some areas to provide escape and thermal cover for the big game animals.

The Brannan soil is in the Mixed Fir-Princes Pine woodland understory site.

24E—Brannan channery silt loam, 35 to 50 percent north slopes. This deep, well drained soil is on mountains. It formed in colluvium derived from schist and influenced by volcanic ash in the surface layer. Areas are irregular in shape and are 80 to 400 acres in size. The native vegetation is mainly conifers, shrubs, and forbs. Elevation is 4,000 to 6,000 feet. The average annual precipitation is 20 to 35 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 30 to 60 days.

Typically, the surface is covered with a mat of partially decomposed needles, twigs, and grasses about 1 inch thick. The surface layer is very dark grayish brown channery silt loam about 4 inches thick. The upper part of the subsoil is dark yellowish brown channery silt loam about 10 inches thick. The lower part is brown very channery sandy clay loam about 14 inches thick. The substratum is brown very channery sandy clay loam. It extends to a depth of about 48 inches. The mantle of volcanic ash is 14 to 20 inches thick.

Included in this unit are small areas of Inkler and Piersonte soils. Also included are small areas of Crackler and Rouen soils. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate in the Brannan soil. Available water capacity is 4 to 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 mainly for timber production. It also is used for livestock grazing, and it provides habitat for many kinds of wildlife.

Woodland.—This unit is suited to the production of Douglas-fir and grand fir. The mean site index is 50 for Douglas-fir (50-year base age) and 63 for grand fir (50-year base age). The potential production at culmination of the mean annual increment for Douglas-fir is 29 cubic feet per acre per year (2.0 cubic meters per hectare per year) in a 116-year-old, even-aged, fully stocked stand and for grand fir is 81 cubic feet per acre per year (5.7 cubic meters per hectare per year) in a 118-year-old, even-aged, fully stocked stand.

The main concerns in producing and harvesting timber are the hazard of erosion, the equipment limitation, seedling mortality, plant competition, and fire damage to the soil.

Minimizing the risk of erosion is essential in areas where timber is harvested. Properly designed road drainage systems that include carefully located culverts help to control erosion. Spoil from excavations is subject to rill and gully erosion and to sloughing. Roads, landings, skid trails, and firebreaks can be protected against erosion by constructing water bars and by seeding areas that have been cut and filled. Buffer strips may be needed in areas adjacent to perennial streams to minimize siltation and maintain stream temperatures.

The slope restricts the use of wheeled and tracked equipment on skid trails. High-lead or other logging systems that fully or partially suspend the logs above the ground will damage the soil less than tractor systems and reduce the risk of compaction. The risk of compaction also can be reduced by using suitable harvesting methods, laying out skid trails in advance, and harvesting timber when the soil is dry or frozen.

Careful management of reforestation is needed to minimize competition from undesirable plants. If the site is not adequately prepared, plant competition can prevent or delay reestablishment of volunteer or planted trees. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying. Scarification is severely restricted in the steeper areas because of increased expense and soil displacement.

The seedling mortality rate is increased by compaction of the surface layer because compaction limits the movement of water and air in the soil and restricts the growth of roots. The high content of rock fragments also limits seedling survival. To compensate for the higher expected mortality rate, larger seedlings or a greater number of seedlings than is typical can be planted. The trees that are suitable for planting include Douglas-fir, western larch, and grand fir.

Some decline in forest productivity may result from fire of moderate intensity.

Grazable woodland.—This unit is suitable for use as grazable woodland. The understory consists mainly of princes pine, myrtle pachystima, elk sedge, heartleaf arnica, pyrola, and western rattlesnake plantain.

A system that results in proper grazing use is essential if livestock graze this unit. Timely deferment of grazing is needed to allow the desirable plants to mature and set seed. Because of steep, unstable slopes, grazing should be delayed in spring until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.

Seeding disturbed areas to suitable plants reduces the hazard of erosion and provides forage for livestock and wildlife. Deferred grazing is needed during periods when seedlings are becoming established.

This soil can produce adequate forage for big game animals after the tree canopy is opened by logging, fire, or some other disturbance. Dense stands of timber should be left in some areas to provide escape and thermal cover for the big game animals.

The Brannan soil is in the Mixed Fir-Princes Pine woodland understory site.

24F—Brannan channery silt loam, 50 to 70 percent north slopes. This deep, well drained soil is on mountains. It formed in colluvium derived from schist and influenced by volcanic ash in the surface layer. Areas are irregular in shape and are 80 to 400 acres in size. The native vegetation is mainly conifers, shrubs, and forbs. Elevation is 4,000 to 6,000 feet. The average annual precipitation is 20 to 35 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 30 to 60 days.

Typically, the surface is covered with a mat of partially decomposed needles, twigs, and grasses about 1 inch thick. The surface layer is very dark grayish brown channery silt loam about 4 inches thick. The upper part of the subsoil is dark yellowish brown channery silt loam about 10 inches thick. The lower part is brown very channery sandy clay loam about 14 inches thick. The substratum is brown very channery sandy clay loam. It extends to a depth of about 48 inches. The mantle of volcanic ash is 14 to 20 inches thick.

Included in this unit are small areas of Inkler and Piersonte soils. Also included are small areas of Crackler and Rouen soils. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate in the Brannan soil. Available water capacity is 4 to 7 inches. The effective rooting depth is 40 to 60 inches. Runoff is rapid, and the hazard of water erosion is very high.

This unit is used mainly for timber production. It also provides habitat for many kinds of wildlife.

Woodland.—This unit is suited to the production of Douglas-fir and grand fir. The mean site index is 50 for Douglas-fir (50-year base age) and 63 for grand fir (50-year base age). The potential production at culmination of the mean annual increment for Douglas-fir is 29 cubic feet per acre per year (2.0 cubic meters per hectare per year) in a 116-year-old, even-aged, fully stocked stand and for grand fir is 81 cubic feet per acre per year (5.7 cubic meters per hectare per year) in a 118-year-old, even-aged, fully stocked stand.

The main concerns in producing and harvesting timber are the hazard of erosion, the equipment limitation, seedling mortality, plant competition, and fire damage to the soil.

Minimizing the risk of erosion is essential in areas where timber is harvested. Properly designed road drainage systems that include carefully located culverts help to control erosion. Spoil from excavations is subject to rill and gully erosion and to sloughing. Roads and landings can be protected against erosion by constructing water bars and by seeding areas that have been cut and filled. Buffer strips may be needed in areas adjacent to perennial streams to minimize siltation and maintain stream temperatures.

The slope prevents the use of wheeled and tracked equipment. High-lead or other logging systems that fully suspend the logs above the ground will damage the soil less than other systems. The risk of compaction can be reduced by using suitable harvesting methods and by harvesting when the soil is dry or frozen.

Careful management of reforestation is needed to minimize competition from undesirable plants. If the site is not adequately prepared, plant competition can prevent or delay reestablishment of volunteer or planted trees. Competing weeds, brush, or trees can be controlled by spraying, cutting, or girdling.

The high content of rock fragments limits seedling survival. To compensate for the higher expected mortality rate, larger seedlings or a greater number of seedlings than is typical can be planted. The trees that are suitable for planting include Douglas-fir, western larch, and grand fir.

Some decline in forest productivity may result from fire of moderate intensity.

The understory consists mainly of princes pine, myrtle pachystima, elk sedge, heartleaf arnica, pyrola, and western rattlesnake plantain.

This soil can produce adequate forage for big game animals after the tree canopy is opened by logging, fire, or some other disturbance. Dense stands of timber should be left in some areas to provide escape and thermal cover for the big game animals.

The Brannan soil is in the Mixed Fir-Princes Pine woodland understory site.

25C—Brownlee-Shangland loams, 2 to 12 percent slopes. This map unit is on hills. Areas are irregular in shape and are 40 to 400 acres in size. The native vegetation is mainly bunchgrasses, shrubs, and forbs. Elevation is 3,600 to 4,000 feet. The average annual precipitation is 16 to 20 inches, the average annual air temperature is 45 to 49 degrees F, and the average frost-free period is 110 to 130 days.

This unit is about 60 percent Brownlee loam and 30 percent Shangland loam. The Brownlee soil is in concave areas, and the Shangland soil is in convex areas. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of soils that are similar to the Shangland soil but are less than 20 inches deep over bedrock and are on ridgetops. Also included are small areas of soils that are similar to the Brownlee soil but are more than 60 inches deep over bedrock. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

The Brownlee soil is deep and well drained. It formed in residuum derived from granodiorite and related granitic rocks. Typically, the surface layer is very dark brown loam about 10 inches thick. The upper 20 inches of the subsoil is very dark grayish brown and dark brown clay loam. The lower 6 inches is dark brown sandy clay loam. The substratum is dark yellowish brown sandy loam about 6 inches thick. The depth to partially weathered bedrock is 40 to 60 inches.

Permeability is moderate to a depth of about 17 inches in the Brownlee soil and moderately slow below that depth. Available water capacity is 6 to 9 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.

The Shangland soil is moderately deep and well drained. It formed in residuum derived from granodiorite and related granitic rocks. Typically, the surface layer is very dark grayish brown loam about 8 inches thick. The subsoil is dark brown sandy loam about 8 inches thick. The substratum is yellowish brown loamy sand about 7 inches thick. The depth to partially weathered bedrock is 20 to 40 inches.

Permeability is moderate to a depth of about 8 inches in the Shangland soil and moderately rapid below that depth. Available water capacity is 3 to 6 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 mainly for livestock grazing (fig. 6). It also is used for nonirrigated small grain and hay production, and it provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on this unit is dominated by Idaho fescue, bluebunch wheatgrass, mountain big sagebrush, and squaw apple.

Idaho fescue is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 2,000 pounds per acre in favorable years and 1,200 pounds per acre in unfavorable years.

If the condition of the site deteriorates through overgrazing, Idaho fescue loses vigor and decreases in extent. Thurber needlegrass and mountain big sagebrush increase in extent. If deterioration continues, the extent of Thurber needlegrass decreases and unpalatable annual grasses and forbs invade the site.

Hay or cropland.—If this unit is used for dryland small grain or hay, the main management concern is the hazard of erosion in the steeper areas.

The main needs in crop management are to protect the soil from water erosion and to conserve soil moisture for plant growth. Practices that can be used to control erosion include early fall seeding, stubble-mulching or no-till, and construction of terraces, diversions, and grassed waterways. Crop residue left on or near the surface helps to conserve moisture, maintain tilth, and control erosion. Limited tillage for seedbed preparation and weed control helps to control runoff and erosion. All tillage should be on the contour or across the slope.

Fertilizer is needed to ensure the optimum growth of grasses, legumes, and other crops. The fertility of this soil can be improved by returning crop residue to the soil.

The trees and shrubs grown as windbreaks and environmental plantings should be those that are tolerant of droughty conditions. A low available water capacity causes moderate seedling mortality. Continued cultivation, mulching, or applications of herbicide to control competing vegetation are needed to ensure the

Figure 6.—In the foreground: an area of Brownlee-Shangland loams, 2 to 12 percent slopes, used for livestock grazing.

establishment and survival of seedlings. Irrigation may be needed when the trees and shrubs are planted and during dry periods.

The Brownlee soil and the Shangland soil are in the Shrubby Mountain Loamy 16-20pz range site.

26D—Brownlee-Shangland loams, 12 to 35 percent south slopes. This map unit is on hills. Areas are irregular in shape and are 40 to 200 acres in size. The native vegetation is mainly bunchgrasses, shrubs, and forbs. Elevation is 3,600 to 4,000 feet. The average annual precipitation is 16 to 20 inches, the average annual air temperature is 45 to 49 degrees F, and the average frost-free period is 110 to 130 days.

This unit is about 50 percent Brownlee loam and 35 percent Shangland loam. The Brownlee soil is in concave areas, and the Shangland soil is in convex areas. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of soils that are similar to the Shangland soil but are less than 20 inches deep over bedrock. Also included are small areas of soils that are similar to the Brownlee soil but are more than 60 inches deep over bedrock. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Brownlee soil is deep and well drained. It formed in residuum derived from granodiorite and related granitic rocks. Typically, the surface layer is very dark brown loam about 10 inches thick. The upper 20 inches of the subsoil is very dark grayish brown and dark brown clay loam. The lower 6 inches is dark brown sandy clay loam. The substratum is dark yellowish brown sandy loam about 6 inches thick. The depth to partially weathered bedrock is 40 to 60 inches.

Permeability is moderate to a depth of about 17 inches in the Brownlee soil and moderately slow below that depth. Available water capacity is 6 to 9 inches. The effective rooting depth is 40 to 60 inches. Runoff is

medium, and the hazard of water erosion is moderate or high.

The Shangland soil is moderately deep and well drained. It formed in residuum derived from granodiorite. Typically, the surface layer is very dark grayish brown loam about 8 inches thick. The subsoil is dark brown sandy loam about 8 inches thick. The substratum is yellowish brown loamy sand about 7 inches thick. The depth to partially weathered bedrock is 20 to 40 inches.

Permeability is moderately rapid in the Shangland soil. Available water capacity is 3 to 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 mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on this unit is dominated by bluebunch wheatgrass, antelope bitterbrush, squaw apple, and mountain big sagebrush.

Bluebunch wheatgrass is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 1,800 pounds per acre in favorable years and 1,000 pounds per acre in unfavorable years.

If the condition of the site deteriorates through overgrazing, bluebunch wheatgrass loses vigor and decreases in extent. Mountain big sagebrush, buckwheat, and blue wildrye increase in extent. If deterioration continues, the extent of needlegrass and blue wildrye decreases and annual forbs and grasses invade the site.

The Brownlee soil and the Shangland soil are in the Shrubby Mountain South 16-20pz range site.

27C—Brownscombe silt loam, 2 to 12 percent slopes. This moderately deep, well drained soil is on hills. It formed in colluvium and residuum derived from diorite and related granitic rocks. Areas are irregular in shape and are 20 to 200 acres in size. The native vegetation is mainly bunchgrasses, forbs, and shurbs. Elevation is 2,400 to 3,400 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 110 to 130 days.

Typically, the surface layer is very dark grayish brown and dark brown silt loam about 12 inches thick. The upper 6 inches of the subsoil is dark yellowish brown sandy clay loam. The lower 7 inches is dark brown sandy clay. The depth to bedrock is 20 to 40 inches.

Included in this unit are small areas of Glasgow soils. Also included are small areas of soils that are similar to the Brownscombe soil but are more than 40 inches deep over bedrock. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate to a depth of about 12 inches in the Brownscombe soil and moderately slow below that depth. Available water capacity is 3 to 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 mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on this unit is dominated by Idaho fescue, needleandthread, and Wyoming big sagebrush.

Idaho fescue and needleandthread are the major forage-producing plants. If the site is in excellent condition, the total annual production is estimated at 1,500 pounds per acre in favorable years and 500 pounds per acre in unfavorable years.

If the condition of the site deteriorates through overgrazing, Idaho fescue loses vigor and decreases in extent. Needleandthread, Thurber needlegrass, Sandberg bluegrass, and Wyoming big sagebrush increase in extent. If deterioration continues, the extent of needlegrass decreases and cheatgrass and other annual grasses and forbs invade the site.

The Brownscombe soil is in the Clayey 9-12pz range site.

28D—Brownscombe silt loam, 12 to 35 percent north slopes. This moderately deep, well drained soil is on hills. It formed in colluvium and residuum derived from diorite and related granitic rocks. Areas are irregular in shape and are 40 to 200 acres in size. The native vegetation is mainly bunchgrasses, forbs, and shrubs. Elevation is 2,400 to 3,400 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 110 to 130 days.

Typically, the surface layer is very dark grayish brown and dark brown silt loam about 12 inches thick. The upper 6 inches of the subsoil is dark yellowish brown sandy clay loam. The lower 7 inches is dark brown sandy clay. The depth to bedrock is 20 to 40 inches.

Included in this unit are small areas of soils that are similar to the Brownscombe soil but are more than 40 inches deep over bedrock. Also included are small areas of Rock outcrop. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate to a depth of about 12 inches in the Brownscombe soil and moderately slow below that depth. Available water capacity is 3 to 5 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 mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on this unit is dominated by Idaho fescue, bluebunch wheatgrass, and Wyoming and basin big sagebrush.

Idaho fescue and bluebunch wheatgrass are the major forage-producing plants. If the site is in excellent condition, the total annual production is estimated at 1,700 pounds per acre in favorable years and 600 pounds per acre in unfavorable years.

If the condition of the site deteriorates through overgrazing, bluebunch wheatgrass loses vigor and decreases in extent. Sandberg bluegrass and big sagebrush increase in extent. If deterioration continues, the extent of unpalatable perennial forbs increases and cheatgrass and other annual grasses and forbs invade the site.

The Brownscombe soil is in the North 9-12pz range site.

29D—Brownscombe silt loam, 12 to 35 percent south slopes. This moderately deep, well drained soil is on hills. It formed in colluvium and residuum derived from diorite and related granitic rocks. Areas are irregular in shape and are 40 to 200 acres in size. The native vegetation is mainly bunchgrasses, forbs, and shrubs. Elevation is 2,400 to 3,400 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 110 to 130 days.

Typically, the surface layer is very dark grayish brown and dark brown silt loam about 12 inches thick. The upper 6 inches of the subsoil is dark yellowish brown sandy clay loam. The lower 7 inches is dark brown sandy clay. The depth to bedrock is 20 to 40 inches.

Included in this unit are Rock outcrop and small areas of soils that are similar to the Brownscombe soil but are less than 20 inches deep over granitic bedrock. Also included are small areas of soils that are similar to the Brownscombe soil but are more than 40 inches deep over bedrock. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate to a depth of about 12 inches in the Brownscombe soil and moderately slow below that depth. Available water capacity is 3 to 5 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 mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on this unit is dominated by bluebunch wheatgrass and Wyoming big sagebrush.

Bluebunch wheatgrass is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 1,200 pounds per acre in favorable years and 400 pounds per acre in unfavorable years.

If the condition of the site deteriorates through overgrazing, bluebunch wheatgrass loses vigor and decreases in extent. Sandberg bluegrass and Wyoming big sagebrush increase in extent. If deterioration continues, annual grasses and forbs invade the site.

The Brownscombe soil is in the Clayey South 9-12pz range site.

30E—Brownscombe-Rock outcrop complex, 35 to 60 percent north slopes. This map unit is on hills. Areas are irregular in shape and are 80 to 500 acres in size. The native vegetation is mainly bunchgrasses, forbs, and shrubs. Elevation is 2,400 to 3,400 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 110 to 130 days.

This unit is about 50 percent Brownscombe silt loam and 35 percent Rock outcrop. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of Lickskillet soils. Also included are small areas of soils that are similar to the Brownscombe soil but are more than 40 inches deep over bedrock. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Brownscombe soil is moderately deep and well drained. It formed in colluvium and residuum derived from diorite and related granitic rocks. Typically, the surface layer is very dark grayish brown and dark brown silt loam about 12 inches thick. The upper 6 inches of the subsoil is dark yellowish brown sandy clay loam. The lower 7 inches is brown sandy clay. The depth to bedrock is 20 to 40 inches.

Permeability is moderate to a depth of about 12 inches in the Brownscombe soil and moderately slow below that depth. Available water capacity is 3 to 5 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high or very high.

This unit is used mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on

the Brownscombe soil is dominated by Idaho fescue, bluebunch wheatgrass, and Wyoming and basin big sagebrush.

Idaho fescue and bluebunch wheatgrass are the major forage-producing plants. If the site is in excellent condition, the total annual production is estimated at 1,700 pounds per acre in favorable years and 600 pounds per acre in unfavorable years. Livestock access is limited by the slope and the Rock outcrop.

If the condition of the site deteriorates through overgrazing, Idaho fescue loses vigor and decreases in extent. Bluebunch wheatgrass, Sandberg bluegrass, and big sagebrush increase in extent. If deterioration continues, the extent of bluebunch wheatgrass decreases and cheatgrass and other annual plants invade the site.

Mechanical treatment for brush control and range seeding is not practical because of the slope and the Rock outcrop.

The Brownscombe soil is in the North 9-12pz range site.

31A—Burkemont silty clay loam, 0 to 2 percent slopes. This deep, poorly drained soil is on low terraces. It formed in mixed alluvium. Areas are irregular in shape and are 40 to 200 acres in size. The native vegetation is mainly salt-tolerant grasses and shrubs. Elevation is 3,300 to 3,400 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 110 to 140 days.

Typically, the surface layer is dark grayish brown silty clay loam about 16 inches thick. The upper part of the subsoil is grayish brown, mottled silty clay loam about 9 inches thick. The lower part is grayish brown, mottled clay about 21 inches thick. Below this to a depth of 60 inches or more is light olive brown, mottled silty clay loam.

Included in this unit are small areas of Wingville, Baldock, and Haines soils. Also included are small areas of soils that are similar to the Burkemont soil but are somewhat poorly drained. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderately slow to a depth of about 25 inches in the Burkemont soil and slow below that depth. Available water capacity is 8 to 12 inches. The effective rooting depth is limited by a seasonal high water table at a depth of 1 to 2 feet in winter and spring and by the dense clay layer. This soil is subject to rare flooding. Runoff is slow, and the hazard of water erosion is slight.

This unit is used mainly for irrigated hay and pasture. It also provides habitat for many kinds of wildlife.

Hay and pasture.—If this unit is used for hay and pasture, the main limitations are the seasonal high water table and the high amount of salts in the surface layer.

The high concentration of salts and alkali in the surface layer limits the production of plants suitable for hay and pasture. Leaching of the salts from the surface layer is limited by the high water table. Salt-tolerant species should be selected for planting.

Periodic mowing and clipping help to maintain uniform growth and prevent selective grazing. Proper grazing practices, weed control, and fertilizer are needed to ensure maximum quality of forage.

Conducting fieldwork during wet periods results in deterioration of tilth and destroys soil structure. As a result, it increases the runoff rate. Grazing during wet periods results in compaction of the surface layer. Compaction limits the movement of air in the soil and restricts the growth of roots.

Because of salt concentrations, the selection of trees and shrubs that can be grown as windbreaks and environmental plantings is limited and seedling mortality is severe. The species selected for planting should be those that can withstand excess moisture. Spring planting may be delayed because of the excess moisture.

The Burkemont soil is in the Sodic Meadow range site.

32A—Burntriver silt loam, 0 to 2 percent slopes. This deep, well drained soil is on low stream terraces and alluvial fans. It formed in mixed alluvium influenced by loess and volcanic ash in the surface layer. Areas are elongated and are 40 to 200 acres in size. The native vegetation is mainly bunchgrasses, shrubs, and forbs. Elevation is 3,800 to 4,000 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 60 to 90 days.

Typically, the surface layer is dark grayish brown silt loam about 11 inches thick. The next layer is dark grayish brown silty clay loam about 15 inches thick. The upper 25 inches of the subsoil is dark grayish brown silty clay loam. The lower 9 inches is dark grayish brown gravelly sandy clay loam. The substratum to a depth of 88 inches or more is yellowish brown gravelly sandy clay loam.

Included in this unit are small areas of Marack soils. Also included are small areas of Burntriver soils that have a surface layer gravelly silt loam. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate to a depth of about 11 inches in the Burntriver soil and moderately slow below that depth. Available water capacity is 8 to 12 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 livestock grazing. It also is used for irrigated hay and pasture or small grain, and it provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on this unit is dominated by basin wildrye and basin and mountain big sagebrush.

Basin wildrye is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 5,000 pounds per acre in favorable years and 3,000 pounds per acre in unfavorable years.

If the condition of the site deteriorates through overgrazing, basin wildrye loses vigor and decreases in extent. Basin big sagebrush increases in extent. If deterioration continues, annual plants invade the site.

Hay and pasture or cropland.—This unit is well suited to irrigated hay and pasture and to small grain.

Management that maintains the optimum vigor and quality of forage plants is needed. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition. Periodic mowing and clipping help to maintain uniform growth and prevent selective grazing.

In summer irrigation is needed for maximum crop production. Sprinkler irrigation is a suitable method of applying water. It permits the even, controlled application of water and helps to control runoff. To avoid 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.

Fertilizer is needed to ensure the optimum growth of grasses, legumes, and other crops. 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.

Conducting fieldwork during wet periods results in deterioration of tilth and destroys soil structure. As a result, it increases the runoff rate and the hazard of erosion. Grazing during wet periods results in compaction of the surface layer, poor tilth, and excessive runoff. Compaction limits the movement of air and water in the soil and restricts the growth of roots.

A wide variety of trees and shrubs can be grown as windbreaks and environmental plantings on this soil. Cultivation or applications of herbicide help to remove competing vegetation.

The Burntriver soil is in the Mountain Loamy Bottom range site.

33C—Burntriver gravelly silt loam, 2 to 12 percent slopes. This deep, well drained soil is on low stream terraces and alluvial fans. It formed in mixed alluvium influenced by loess and volcanic ash in the surface layer. Areas are irregular in shape and are 40 to 200 acres in size. The native vegetation is mainly bunchgrasses, shrubs, and forbs. Elevation is 3,800 to 4,000 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 60 to 90 days.

Typically, the surface layer is dark grayish brown gravelly silt loam about 11 inches thick. The next layer is dark grayish brown silty clay loam about 15 inches thick. The upper 25 inches of the subsoil is dark grayish brown silty clay loam. The lower 9 inches is dark grayish brown gravelly clay loam. The substratum to a depth of 60 inches or more is yellowish brown gravelly sandy clay loam.

Included in this unit are small areas of Marack soils. Also included are small areas of Burntriver soils that have a surface layer of silt loam. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate to a depth of about 11 inches in the Burntriver soil and moderately slow below that depth. Available water capacity is 8 to 12 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 livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on this unit is dominated by Idaho fescue, needleandthread, and Wyoming big sagebrush.

Idaho fescue and needleandthread are the major forage-producing plants. If the site is in excellent condition, the total annual production is estimated at 1,500 pounds per acre in favorable years and 500 pounds per acre in unfavorable years.

If the condition of the site deteriorates through overgrazing, Idaho fescue loses vigor and decreases in extent. Thurber needlegrass, needleandthread, Wyoming big sagebrush, and Sandberg bluegrass increase in extent. If deterioration continues, the extent of needlegrass decreases and cheatgrass and other annual grasses and forbs invade the site.

The Burntriver soil is in the Mountain Loamy 9-12pz range site.

34D—Campcreek-Skullgulch association, 12 to 35 percent slopes. This map unit is on terrace side slopes. Areas are irregular in shape and are 100 to 400 acres in size. The native vegetation is mainly bunchgrasses, forbs, and shrubs. Elevation is 4,000 to 4,700 feet. The average annual precipitation is 12 to 16 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 60 to 90 days.

This unit is about 45 percent Campcreek very gravelly loam and 40 percent Skullgulch silt loam. Campcreek soils are on south and west aspects, and Skullgulch soils are on north and east aspects.

Included in this unit are small areas of Nagle soils. Also included are small areas of soils that are similar to the Campcreek soil but are less than 40 inches deep to consolidated sediments. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Campcreek soil is deep and well drained. It formed in mixed alluvium. Typically, the surface layer is very dark grayish brown very gravelly loam about 8 inches thick. The upper part of the subsoil is very dark grayish brown clay loam about 7 inches thick. The lower part is about 50 inches of dark yellowish brown and dark brown clay and silty clay. Depth to the substratum is 60 inches or more.

Permeability is moderate to a depth of about 15 inches in the Campcreek soil and slow below that depth. Available water capacity is 9 to 11 inches. The effective rooting depth is limited by the dense clay layer at a depth of 10 to 20 inches. Runoff is medium, and the hazard of water erosion is moderate or high.

The Skullgulch soil is deep and well drained. It formed in mixed alluvium. Typically, the surface layer is very dark grayish brown and dark brown silt loam about 20 inches thick. The next layer is dark brown clay loam about 4 inches thick. The upper 15 inches of the subsoil is dark yellowish brown clay. The lower 21 inches is dark yellowish brown clay loam. Depth to the substratum is 60 inches or more.

Permeability is moderately slow to a depth of about 24 inches in the Skullgulch soil and slow below that depth. Available water capacity is 8 to 11 inches. The effective rooting depth is limited by the dense clay layer at a depth of 20 to 30 inches. Runoff is medium, and the hazard of water erosion is moderate or high.

This unit is used mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on the Campcreek soil is dominated by bluebunch wheatgrass, Idaho fescue, big sagebrush, squaw apple, and bitterbrush.

Bluebunch wheatgrass and Idaho fescue are the major forage-producing plants. If the site is in excellent condition, the total annual production is estimated at 1,400 pounds per acre in favorable years and 700 pounds per acre in unfavorable years.

The potential plant community on the Skullgulch soil is dominated by Idaho fescue, squaw apple, and mountain big sagebrush.

Idaho fescue is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 2,200 pounds per acre in favorable years and 1,000 pounds per acre in unfavorable years.

If the condition of the site deteriorates through overgrazing, Idaho fescue loses vigor and decreases in extent. Mountain big sagebrush and Sandberg bluegrass increase in extent. If deterioration continues, mountain big sagebrush strongly increases on the north slope of the Skullgulch soil, and cheatgrass, soft brome, and other annual plants invade the site.

The Campcreek soil is in the Mountain South 12-16pz range site. The Skullgulch soil is in the Mountain North 12-16pz range site.

34E—Campcreek-Skullgulch association, 35 to 60 percent slopes. This map unit is on terrace side slopes. Areas are irregular in shape and are 100 to 400 acres in size. The native vegetation is mainly bunchgrasses, forbs, and shrubs. Elevation is 4,000 to 4,700 feet. The average annual precipitation is 12 to 16 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 60 to 90 days.

This unit is about 45 percent Campcreek very gravelly loam and 40 percent Skullgulch silt loam. Campcreek soils are on south and west aspects, and Skullgulch soils are on north and east aspects.

Included in this unit are small areas of soils that are similar to these soils but are less than 40 inches deep to consolidated sediments. Also included are small areas of Badland on south-facing slopes. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Campcreek soil is deep and well drained. It formed in mixed alluvium. Typically, the surface layer is very dark grayish brown very gravelly loam about 8 inches thick. The upper part of the subsoil is very dark grayish brown clay loam about 7 inches thick. The lower part is about 50 inches of dark yellowish brown and dark brown clay and silty clay. Depth to the substratum is 60 inches or more.

Permeability is moderate to a depth of about 15 inches in the Campcreek soil and slow below that depth. Available water capacity is 9 to 11 inches. The effective rooting depth is limited by the dense clay layer at a depth of 10 to 30 inches. Runoff is rapid, and the hazard of water erosion is high or very high.

The Skullgulch soil is deep and well drained. It formed in mixed alluvium. Typically, the surface layer is very dark grayish brown and dark brown silt loam about 20 inches thick. The next layer is dark brown clay loam about 4 inches thick. The upper 15 inches of the subsoil is dark yellowish brown clay. The lower 21 inches is dark yellowish brown clay loam. Depth to the substratum is 60 inches or more.

Permeability is moderate to a depth of about 24 inches in the Skullgulch soil and slow below that depth. Available water capacity is 8 to 11 inches. The effective rooting depth is limited by the dense clay layer at a depth of 20 to 30 inches. Runoff is rapid, and the hazard of water erosion is high or very high.

This unit is used mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on the Campcreek soil is dominated by bluebunch wheatgrass, Idaho fescue, big sagebrush, and squaw apple.

Bluebunch wheatgrass and Idaho fescue are the major forage-producing plants. If the site is in excellent condition, the total annual production is estimated at 1,400 pounds per acre in favorable years and 700 pounds per acre in unfavorable years. Livestock access is limited by the slope.

The potential plant community on the Skullgulch soil is dominated by Idaho fescue, bluebunch wheatgrass, squaw apple, and big sagebrush.

Idaho fescue is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 2,200 pounds per acre in favorable years and 100 pounds per acre in unfavorable years. Livestock access is limited by the slope.

If the condition of the site deteriorates through overgrazing, bluebunch wheatgrass and Idaho fescue lose vigor and decrease in extent. Mountain big sagebrush and Sandberg bluegrass increase in extent. If deterioration continues, mountain big sagebrush strongly increases on the north slope of the Skullgulch soil, and cheatgrass, soft brome, and other annual plants invade the site.

Mechanical treatment for brush control and range seeding is not practical because of the slope.

The Campcreek soil is in the Mountain South 12-16pz range site. The Skullgulch soil is in the Mountain North 12-16pz range site.

35A—Catherine silt loam, 0 to 2 percent slopes. This deep, somewhat poorly drained soil is on flood plains. It formed in mixed alluvium. Areas are irregular in shape and are 20 to 200 acres in size. The native vegetation is mainly water-tolerant grasses and sedges. Elevation is 2,400 to 3,400 feet. The average annual precipitation is 18 to 22 inches, the average annual air temperature is 45 to 48 degrees F, and the average frost-free period is 110 to 130 days.

Typically, the surface layer is black silt loam about 16 inches thick. The next layer is very dark gray, mottled silt loam about 14 inches thick. The upper part of the substratum is very dark grayish brown, mottled silt loam about 18 inches thick. The lower part to a depth of 60 inches or more is very dark grayish brown, mottled fine sandy loam.

Included in this unit are small areas of Hershal, La Grande, and Halfway soils. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate in the Catherine soil. Available water capacity is 10 to 12 inches. The effective rooting depth is limited by a seasonal high water table at a depth of 1.5 to 4.0 feet from winter to early summer. This soil is subject to rare flooding. Runoff is slow, and the hazard of water erosion is slight.

This unit is used mainly for irrigated hay and pasture or small grain. It also provides habitat for many kinds of wildlife.

Hay and pasture or cropland.—If this unit is used as hayland, pasture, or cropland, the main limitation is the seasonal high water table.

Management that maintains the optimum vigor and quality of forage plants is needed. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and control erosion. Periodic mowing and clipping help to maintain uniform growth and prevent selective grazing.

In summer irrigation is needed for the maximum production of hay or crops. Controlled surface or sprinkler irrigation is suited to this unit. The method used is generally governed by the crop grown. Leveling helps to ensure the uniform application of water. To avoid 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.

Fertilizer is needed to ensure the optimum growth of grasses, legumes, and other crops. 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.

Conducting fieldwork during wet periods results in deterioration of tilth and destroys soil structure. As a result, it increases the runoff rate and the hazard of erosion. Compaction limits the movement of air and water in the soil and restricts the growth of roots. Excessive cultivation can result in the formation of a tillage pan. This pan can be broken by subsoiling when the soil is dry.

A wide variety of trees and shrubs can be grown as windbreaks and environmental plantings on this soil. Cultivation or applications of herbicide help to remove competing vegetation.

The Catherine soil is in the Meadow range site.

36C—Clovercreek-Keating complex, 2 to 12 percent slopes. This map unit is on hills. Areas are irregular in shape and are 40 to 200 acres in size. The native vegetation is mainly bunchgrasses, forbs, and shrubs. Elevation is 3,000 to 3,800 feet. The average annual precipitation is 12 to 16 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 130 days.

This unit is about 50 percent Clovercreek very gravelly loam and 35 percent Keating silt loam. The Clovercreek soil is in convex areas, and the Keating soil is in concave areas. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of Ridley soils and Rock outcrop. Also included are small areas of soils that are similar to the Clovercreek soil but are less than 10 inches deep over bedrock. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Clovercreek soil is shallow and well drained. It formed in colluvium derived from greenstone. Typically, the surface layer is very dark brown and very dark grayish brown very gravelly loam about 6 inches thick. The upper 4 inches of the subsoil is very dark grayish brown very gravelly clay loam. The lower 6 inches is dark brown very gravelly clay loam. The depth to bedrock is 14 to 20 inches.

Permeability is moderately slow in the Clovercreek soil. Available water capacity is 1 to 2 inches. The effective rooting depth is 14 to 20 inches. Runoff is slow or medium, and the hazard of water erosion is slight or moderate.

The Keating soil is moderately deep and well drained. It formed in colluvium derived from greenstone and influenced by loess and volcanic ash in the surface layer. Typically, the surface layer is very dark brown silt loam about 8 inches thick. The upper 9 inches of the subsoil is dark brown clay loam. The lower 5 inches is dark yellowish brown clay. The depth to bedrock is 20 to 40 inches.

Permeability is moderate to a depth of about 17 inches in the Keating soil and slow below that depth. Available water capacity is 3 to 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 mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on the Clovercreek soil is dominated by Idaho fescue, mountain big sagebrush, and threetip sagebrush.

Idaho fescue is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 1,500 pounds per acre in favorable years and 500 pounds per acre in unfavorable years.

The potential plant community on the Keating soil is dominated by Idaho fescue and big sagebrush.

Idaho fescue and bluebunch wheatgrass are the major forage-producing plants. If the site is in excellent condition, the total annual production is estimated at 1,800 pounds per acre in favorable years and 1,000 pounds per acre in unfavorable years.

If the condition of the site deteriorates through overgrazing, Idaho fescue loses vigor and decreases in extent. Sandberg bluegrass, needlegrass, threadleaf sedge, big sagebrush, and perennial forbs increase in extent. If deterioration continues, the extent of needlegrass decreases, the extent of big sagebrush strongly increases, and cheatgrass, soft brome, and other annual plants invade the site.

The Clovercreek soil is in the Mountain Shallow 12-16pz range site. The Keating soil is in the Mountain Loamy 12-16pz range site.

37D—Clovercreek-Keating complex, 12 to 35 percent south slopes. This map unit is on rolling hills. Areas are irregular in shape and are 40 to 200 acres in size. The native vegetation is mainly bunchgrasses, forbs, and shrubs. Elevation is 3,000 to 3,800 feet. The average annual precipitation is 12 to 16 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 130 days.

This unit is about 50 percent Clovercreek very gravelly loam and 35 percent Keating silt loam. The Clovercreek soil is in convex areas, and the Keating soil is in concave areas. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of Ridley soils and Rock outcrop. Also included are small areas of soils that are similar to the Clovercreek soil but are less than 10 inches deep over bedrock. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Clovercreek soil is shallow and well drained. It formed in colluvium derived from greenstone. Typically, the surface layer is very dark brown and very dark grayish brown very gravelly loam about 6 inches thick. The upper 4 inches of the subsoil is very dark grayish brown very gravelly clay loam. The lower 6 inches is dark brown very gravelly clay loam. The depth to bedrock is 14 to 20 inches.

Permeability is moderately slow in the Clovercreek soil. Available water capacity is 1 to 2 inches. The effective rooting depth is 14 to 20 inches. Runoff is medium, and the hazard of water erosion is moderate or high.

The Keating soil is moderately deep and well drained. It formed in colluvium derived from greenstone and influenced by loess and volcanic ash in the surface layer. Typically, the surface layer is very dark brown silt loam about 8 inches thick. The upper 9 inches of the subsoil is dark brown clay loam. The lower 5 inches is dark yellowish brown clay. The depth to bedrock is 20 to 40 inches.

Permeability is moderate to a depth of about 17 inches in the Keating soil and slow below that depth. Available water capacity is 3 to 5 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 mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on the Clovercreek soil is dominated by bluebunch wheatgrass and mountain sagebrush.

Bluebunch wheatgrass is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 900 pounds per acre in favorable years and 400 pounds per acre in unfavorable years.

The potential plant community on the Keating soil is dominated by bluebunch wheatgrass, Idaho fescue, mountain big sagebrush, basin big sagebrush, squaw apple, and bitterbrush.

Bluebunch wheatgrass and Idaho fescue are the major forage-producing plants. If the site is in excellent condition, the total annual production is estimated at 1,400 pounds per acre in favorable years and 700 pounds per acre in unfavorable years.

If the condition of the site deteriorates through overgrazing, Idaho fescue and bluebunch wheatgrass lose vigor and decrease in extent. Sandberg bluegrass, mountain big sagebrush, basin big sagebrush, and perennial forbs increase in extent. If deterioration continues, cheatgrass, soft brome, and other annual plants invade the site.

The Clovercreek soil is in the Mountain Shallow South 12-16pz range site. The Keating soil is in the Mountain South 12-16pz range site.

38E—Copperfield-Rock outcrop complex, 30 to 50 percent north slopes. This map unit is on steep side slopes of low-elevation hills and canyon walls. Areas are irregular in shape and are 40 to 200 acres in size. The native vegetation is mainly bunchgrasses, shrubs, and forbs. Elevation is 2,000 to 3,400 feet. The average annual precipitation is 14 to 20 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 120 days.

This unit is about 60 percent Copperfield very cobbly silt loam 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 selected scale.

Included in this unit are small areas of Gwinly and Immig soils. Also included are small areas of soils that are similar to the Copperfield soil but do not have stones and cobbles on the surface. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Copperfield soil is deep and well drained. It formed in colluvium derived from basalt. Typically, the surface layer is black very cobbly silt loam about 8 inches thick. The next layer is very dark gray very gravelly silt loam about 11 inches thick. The upper 23 inches of the subsoil is very dark grayish brown very gravelly silty clay loam and dark brown very cobbly silty clay loam. The lower 18 inches is dark grayish brown extremely cobbly silty clay and clay. The depth to bedrock is typically more than 60 inches but is 40 to 60 inches in some areas.

Permeability is moderate to a depth of about 19 inches in the Copperfield soil and moderately slow below that depth. Available water capacity is 3 to 6 inches. The effective rooting depth is more than 60 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on the Copperfield soil is dominated by Idaho fescue, bluebunch wheatgrass, mockorange, and blue elderberry.

Idaho fescue and bluebunch wheatgrass are the major forage-producing plants. If the site is in excellent condition, the total annual production is estimated at 2,300 pounds per acre in favorable years and 1,300 pounds per acre in unfavorable years. Livestock access is limited by the slope, the Rock outcrop, and the rock fragments on the surface.

If the condition of the site deteriorates through overgrazing, Idaho fescue and bluebunch wheatgrass lose vigor and decrease in extent. Perennial forbs and shrubs increase in extent. If deterioration continues, cheatgrass and other annual plants invade the site.

Mechanical treatment is not practical because of the slope. Brush control is not advisable because of the value of deciduous shrubs on this unit for wildlife food and cover.

The Copperfield soil is in the Low Elevation North 14-18pz range site.

38F—Copperfield-Rock outcrop complex, 50 to 80 percent north slopes. This map unit is on very steep side slopes of low elevation hills and canyon walls. Areas are irregular in shape and are 40 to 200 acres in size. The native vegetation is mainly bunchgrasses, shrubs, and forbs. Elevation is 2,000 to 3,400 feet. The average annual precipitation is 14 to 20 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 120 days.

This unit is about 60 percent Copperfield very cobbly silt loam 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 selected scale.

Included in this unit are small areas of Gwinly and Immig soils. Also included are small areas of soils that are similar to the Copperfield soil but do not have stones and cobbles on the surface. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Copperfield soil is deep and well drained. It formed in colluvium derived from basalt. Typically, the surface layer is black very cobbly silt loam about 8 inches thick. The next layer is very dark gray very gravelly silt loam about 11 inches thick. The upper 23 inches of the subsoil is very dark grayish brown very gravelly silty clay loam and dark brown very cobbly silty clay loam. The lower 18 inches is dark grayish brown extremely cobbly silty clay and clay. The depth to bedrock is typically more than 60 inches but is 40 to 60 inches in some areas.

Permeability is moderate to a depth of about 19 inches in the Copperfield soil and moderately slow below that depth. Available water capacity is 3 to 6 inches. The effective rooting depth is more than 60 inches. Runoff is rapid, and the hazard of water erosion is very high.

This unit is used mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on the Copperfield soil is dominated by Idaho fescue, bluebunch wheatgrass, mockorange, and blue elderberry.

Idaho fescue and bluebunch wheatgrass are the major forage-producing plants. If the site is in excellent condition, the total annual production is estimated at 2,300 pounds per acre in favorable years and 1,300 pounds per acre in unfavorable years. Livestock access is limited by the slope, the Rock outcrop, and the rock fragments on the surface.

If the condition of the site deteriorates through improper use, Idaho fescue and bluebunch wheatgrass lose vigor and decrease in extent. Perennial forbs and shrubs increase in extent. If deterioration continues, cheatgrass and other annual plants invade the site.

Mechanical treatment is not practical because of the slope. Brush control is not advisable because of the value of deciduous shrubs on this unit for wildlife food and cover.

The Copperfield soil is in the Low Elevation North 14-18pz range site.

39D—Crackler-Rouen gravelly silt loams, 2 to 30 percent north slopes. This map unit is on mountains. Areas are irregular in shape and are 100 to 400 acres in size. The native vegetation is mainly conifers, shrubs, and grasses. Elevation is 3,800 to 6,200 feet. The average annual precipitation is 20 to 35 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 30 to 50 days.

This unit is about 50 percent Crackler gravelly silt loam and 35 percent Rouen gravelly silt loam. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of Brannan, Inkler, and Tolo soils. Inluded areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Crackler soil is deep and well drained. It formed in colluvium derived from argillite and has a mantle of volcanic ash. Typically, the surface is covered with a mat of partially decomposed needles, grass, and twigs about 1 inch thick. The surface layer is dark brown and brown gravelly silt loam about 17 inches thick. The upper part of the subsoil is brown very cobbly silty clay loam about 17 inches thick. The lower part is dark yellowish brown extremely gravelly clay loam about 20 inches thick. The depth to bedrock is 40 to 60 inches. The mantle of volcanic ash is 14 to 25 inches thick.

Permeability is moderate to a depth of about 17 inches in the Crackler soil and moderately slow below that depth. Available water capacity is 6 to 11 inches. The effective rooting depth is 40 to 60 inches. Runoff is medium, and the hazard of water erosion is moderate or high.

The Rouen soil is moderately deep and well drained. It formed in colluvium derived from argillite and has a mantle of volcanic ash. Typically, the surface is covered with a mat of partially decomposed needles, leaves, and twigs about 1 inch thick. The surface layer is dark brown and dark yellowish brown gravelly silt loam about

16 inches thick. The upper part of the subsoil is dark yellowish brown extremely gravelly silty clay loam about 7 inches thick. The lower part is yellowish brown extremely gravelly clay loam about 8 inches thick. The depth to bedrock is 20 to 40 inches. The mantle of volcanic ash is 14 to 25 inches thick.

Permeability is moderate to a depth of about 16 inches in the Rouen soil and moderately slow below that depth. Available water capacity is 4 to 8 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 mainly for timber production. It also is used for livestock grazing, and it provides habitat for many kinds of wildlife.

Woodland.—The Crackler soil is suited to the production of Douglas-fir and grand fir. The mean site index is 68 for Douglas-fir (50-year base age) and 58 for grand fir (50-year base age). The potential production at culmination of the mean annual increment for Douglas-fir is 58 cubic feet per acre per year (4.1 cubic meters per hectare per year) in a 104-year-old, even-aged, fully stocked stand and for grand fir is 72 cubic feet per acre per year (5.0 cubic meters per hectare per year) in a 120-year-old, even-aged, fully stocked stand.

The Rouen soil is suited to the production of Douglas-fir. The mean site index is 62 for Douglas-fir (50-year base age). The potential production at culmination of the mean annual increment for Douglas-fir is 47 cubic feet per acre per year (3.3 cubic meters per hectare per year) in a 109-year-old, even-aged, fully stocked stand.

The main concerns in producing and harvesting timber are the hazard of erosion, the equipment limitation, the hazard of windthrow on the Rouen soil, and plant competition.

Minimizing the risk of erosion is essential in areas where timber is harvested. Properly designed road drainage systems that include carefully located culverts help to control erosion. Spoil from excavations is subject to rill and gully erosion and to sloughing. Roads, landings, skid trails, and firebreaks can be protected against erosion by constructing water bars and by seeding areas that have been cut and filled. Buffer strips may be needed in areas adjacent to perennial streams to minimize siltation and maintain stream temperatures.

Using standard wheeled or tracked equipment when the soil is moist causes rutting and compaction. Displacement of the surface layer occurs most readily when the soil is dry. The risk of compaction can be reduced by using low-pressure ground equipment, laying out skid trails in advance, and harvesting timber when the soil is dry or frozen. Cable yarding systems that partially or fully suspend logs generally do less damage to the soil than conventional ground-based systems.

Careful management of reforestation is needed to minimize competition from undesirable plants. If the site is not adequately prepared, plant competition can prevent or delay reestablishment of volunteer or planted trees. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying. The trees that are suitable for planting include Douglas-fir and western larch.

Trees are subject to windthrow because of the limited rooting depth in the Rouen soil. They are particularly susceptible when the soil is excessively wet and winds are strong. Regeneration systems that isolate single trees or groups of trees are not practical because of the hazard of windthrow.

Grazable woodland.—This unit is suitable for use as grazable woodland. The understory consists mainly of princes pine, myrtle pachystima, elk sedge, heartleaf arnica, pyrola, and western rattlesnake plantain.

A system that results in proper grazing use is essential if livestock graze this unit. Timely deferment of grazing is needed to allow the desirable plants to mature and set seed. Grazing should be delayed in spring until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.

Seeding disturbed areas to suitable plants reduces the hazard of erosion and provides forage for livestock and wildlife. Deferred grazing is needed during periods when seedlings are becoming established.

This unit can produce adequate forage for big game animals after the tree canopy is opened by logging, fire, or some other disturbance. Dense stands of timber should be left in some areas to provide escape and thermal cover for the big game animals.

The Crackler and Rouen soils are in the Mixed Fir-Princes Pine woodland understory site.

39E—Crackler-Rouen gravelly silt loams, 30 to 50 percent north slopes. This map unit is on mountains. Areas are irregular in shape and are 100 to 400 acres in size. The native vegetation is mainly conifers, shrubs, and grasses. Elevation is 3,800 to 6,200 feet. The average annual precipitation is 20 to 35 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 30 to 50 days.

This unit is about 45 percent Crackler gravelly silt loam and 40 percent Rouen gravelly silt loam. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of Brannan and

Stices soils. Also included are small areas of Inkler and Tolo soils and Rock outcrop. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Crackler soil is deep and well drained. It formed in colluvium derived dominantly from argillite and has a mantle of volcanic ash. Typically, the surface is covered with a mat of partially decomposed needles, grass, and twigs about 1 inch thick. The surface layer is dark brown and brown gravelly silt loam about 17 inches thick. The upper part of the subsoil is brown very cobbly silty clay loam about 17 inches thick. The lower part is dark yellowish brown extremely gravelly clay loam about 9 inches thick. The depth to bedrock is 40 to 60 inches. The mantle of volcanic ash is 14 to 25 inches thick.

Permeability is moderate to a depth of about 17 inches in the Crackler soil and moderately slow below that depth. Available water capacity is 6 to 11 inches. The effective rooting depth is 40 to 60 inches. Runoff is rapid, and the hazard of water erosion is high.

The Rouen soil is moderately deep and well drained. It formed in colluvium derived from argillite and has a mantle of volcanic ash. Typically, the surface is covered with a mat of partially decomposed needles, leaves, and twigs about 1 inch thick. The surface layer is dark brown and dark yellowish brown gravelly silt loam about 16 inches thick. The upper part of the subsoil is dark yellowish brown extremely gravelly silty clay loam about 7 inches thick. The lower part is yellowish brown extremely gravelly clay loam about 8 inches thick. The depth to bedrock is 20 to 40 inches. The mantle of volcanic ash is 14 to 25 inches thick.

Permeability is moderate to a depth of about 16 inches in the Rouen soil and moderately slow below that depth. Available water capacity is 4 to 8 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 timber production. It also is used for livestock grazing, and it provides habitat for many kinds of wildlife.

Woodland.—The Crackler soil is suited to the production of Douglas-fir and grand fir. The mean site index is 68 for Douglas-fir (50-year base age) and 58 for grand fir (50-year base age). The potential production at culmination of the mean annual increment for Douglas-fir is 58 cubic feet per acre per year (4.1 cubic meters per hectare per year) in a 104-year-old, even-aged, fully stocked stand and for grand fir is 72 cubic feet per acre per year (5.0 cubic meters per hectare per year) in a 120-year-old, even-aged, fully stocked stand.

The Rouen soil is suited to the production of Douglas-fir. The mean site index is 62 for Douglas-fir (50-year base age). The potential production at culmination of the mean annual increment for Douglas-fir is 47 cubic feet per acre per year (3.3 cubic meters per hectare per year) in a 109-year-old, even-aged, fully stocked stand.

The main concerns in producing and harvesting timber are the hazard of erosion, the equipment limitation, the hazard of windthrow on the Rouen soil, plant competition, and fire damage to the soil.

Minimizing the risk of erosion is essential in areas where timber is harvested. Properly designed road drainage systems that include carefully located culverts help to control erosion. Spoil from excavations is subject to rill and gully erosion and to sloughing. Roads, landings, skid trails, and firebreaks can be protected against erosion by constructing water bars and seeding areas that have been cut and filled. Buffer strips may be needed in areas adjacent to perennial streams to minimize siltation and maintain stream temperatures.

The slope restricts the use of wheeled and tracked equipment on skid trails. High-lead or other logging systems that fully or partially suspend the logs above the ground will damage the soil less than tractor systems and reduce the risk of compaction. The risk of compaction also can be reduced by using suitable harvesting methods, laying out skid trails in advance, and harvesting timber when the soil is dry or frozen.

Reforestation must be carefully managed to reduce competition from undesirable plants. If the site is not adequately prepared, plant competition can prevent or delay reestablishment of volunteer or planted trees. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying. Scarification is severely restricted in the steeper areas because of increased expense and soil displacement. The trees that are suitable for planting include Douglas-fir and western larch.

Trees are subject to windthrow because of the limited rooting depth in the Rouen soil. They are particularly susceptible when the soil is excessively wet and winds are strong. Regeneration systems that isolate single trees or groups of trees are not practical because of the hazard of windthrow.

Some decline in forest productivity may result from fire of moderate intensity.

Grazable woodland.—This unit is suitable for use as grazable woodland. The understory consists mainly of princes pine, myrtle pachystima, elk sedge, heartleaf arnica, pyrola, and western rattlesnake plantain.

A system that results in proper grazing use is an essential practice if livestock graze this unit. Timely deferment of grazing is needed to allow the desirable plants to mature and set seed. Grazing should be delayed in spring until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.

Seeding disturbed areas to suitable plants reduces the hazard of erosion and provides forage for livestock and wildlife. Deferred grazing is needed during periods when seedlings are becoming established.

This unit can produce adequate forage for big game animals after the tree canopy is opened by logging, fire, or some other disturbance. Dense stands of timber should be left in some areas to provide escape and thermal cover for the big game animals.

The Crackler and Rouen soils are in the Mixed Fir-Princes Pine woodland understory site.

40A—Cumulic Haploxerolls, 0 to 2 percent slopes. These deep, well drained and moderately well drained soils are on flood plains. They formed in stratified, mixed alluvium. Areas are elongated and are 25 to 80 acres in size. The native vegetation is mainly bunchgrasses and shrubs. Elevation is 2,000 to 3,600 feet. The average annual precipitation is 9 to 20 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 140 days.

Typically, the surface layer is very dark brown and very dark grayish brown loam about 11 inches thick. The next layer is very dark grayish brown sandy loam about 14 inches thick. The upper 8 inches of the substratum is dark brown loamy sand. The lower part to a depth of 60 inches or more is multicolored extremely gravelly sand. Depth to the sandy or gravelly substratum is 20 to 40 inches.

Included in this unit are small areas of Balm and Boyce soils. Also included are small areas of Riverwash. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate or moderately rapid to a depth of about 25 inches in the Cumulic Haploxerolls and very rapid below that depth. The effective rooting depth is 30 to 40 inches. Available water capacity is 4 to 6 inches. Runoff is slow, and the hazard of water erosion is slight. A seasonal high water table fluctuates between depths of 2 to 4 feet in winter and spring. The soils are occasionally flooded for brief periods in winter and spring.

This unit is used mainly for hay and pasture. It also provides habitat for many kinds of wildlife.

Hay and pasture.—If this unit is used for hay and pasture, the main limitation is a moderately low available water capacity.

In summer irrigation is needed for the maximum production of hay. The method used generally is governed by the crop. Controlled surface irrigation is a suitable method of applying water. Leveling helps to ensure the uniform application of water. To avoid 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.

Fertilizer is needed for the maximum production of hay. 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.

Conducting fieldwork during wet periods results in deterioration of tilth and destroys soil structure. Grazing during wet periods results in compaction of the surface layer. Compaction limits the movement of air and water in the soil and restricts the growth of roots.

Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition. Periodic mowing and clipping help to maintain uniform growth and prevent selective grazing.

The Cumulic Haploxerolls are in the Loamy Bottom range site.

41A—Damore-Silvies silt loams, 0 to 3 percent slopes. This unit is on flood plains. Areas are irregular in shape and are 20 to 200 acres in size. The native vegetation is mainly water-tolerant grasses, rushes, and sedges. Elevation is 3,700 to 5,000 feet. The average annual precipitation is 12 to 25 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 50 to 90 days.

This unit is about 50 percent Damore silt loam and 35 percent Silvies silt loam. The Damore soil is in a slightly higher convex position, and the Silvies soil is in depressions. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

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

The Damore soil is deep and somewhat poorly drained. It formed in mixed alluvium influenced by loess and volcanic ash in the surface layer. Typically, the surface layer is very dark brown silt loam about 12 inches thick. The next layer is very dark grayish brown silty clay loam about 10 inches thick. The upper part of the subsoil is dark yellowish brown, mottled silty clay loam about 12 inches thick. The lower part is brown and olive brown, mottled silty clay about 18 inches thick. The substratum to a depth of 60 inches or more is olive brown gravelly clay.

Permeability is moderately slow to a depth of about 34 inches in the Damore soil and slow below that depth. Available water capacity is 7 to 10 inches. The effective rooting depth is limited by a seasonal high water table at a depth of 1 to 2 feet in spring and early summer.

This soil is occasionally flooded for very brief periods in spring and early summer. Runoff is slow to ponded, and the hazard of water erosion is slight.

The Silvies soil is deep and poorly drained. It formed in mixed alluvium influenced by loess and volcanic ash in the surface layer. Typically, the surface layer is black silt loam about 17 inches thick. The next layer is very dark gray, mottled silty clay loam about 12 inches thick. The substratum to a depth of 60 inches or more is very dark grayish brown silty clay and clay.

Permeability is slow in the Silvies soil. Available water capacity is 10 to 13 inches. The effective rooting depth is limited by a seasonal high water table 1 foot above to 2 feet below the surface in spring and early summer. This soil is occasionally flooded for very brief periods in spring and early summer. Runoff is very slow or ponded, and the hazard of water erosion is slight.

This unit is used mainly for hay and pasture. It also provides habitat for many kinds of wildlife.

Hay and pasture.—If this unit is used for hay and pasture, the main limitation is the seasonal high water table.

Plants suited to soils that have a high water table and excessive wetness should be seeded on this site. Wetness limits the choice of plants and the period of cutting or grazing.

Conducting fieldwork during wet periods results in deterioration of tilth and destroys soil structure. As a result, it increases the runoff rate and the hazard of erosion. Grazing during wet periods results in compaction of the surface layer, poor tilth, and excessive runoff. Compaction limits the movement of air and water in the soil and restricts the growth of roots.

Fertilizer is needed to ensure the optimum growth of grasses and legumes.

In summer irrigation is needed for the maximum production of hay. Controlled surface irrigation is a suitable method of applying water. Leveling helps to ensure the uniform application of water. To avoid 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.

Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition. Periodic mowing and clipping help to maintain uniform growth and prevent selective grazing.

This unit is generally unsuited to the trees and shrubs grown as windbreaks and environmental plantings. Onsite investigation is needed to identify areas where trees and shrubs can be planted if special management is applied.

The Damore soil is in the Mountain Meadow range site. The Silvies soil is in the Wet Mountain Meadow range site.

42D—Derringer-Harlow complex, 12 to 35 percent south slopes. This map unit is on mountains. Areas are irregular in shape and are 80 to 200 acres in size. The native vegetation is mainly bunchgrasses, shrubs, and forbs. Elevation is 4,000 to 5,700 feet. The average annual precipitation is 16 to 20 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 50 to 90 days.

This unit is about 50 percent Derringer very gravelly loam and 35 percent Harlow extremely stony clay loam. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

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

The Derringer soil is moderately deep and well drained. It formed in colluvium derived from argillite, breccia, and rhyolitic tuff. Typically, the surface layer is very dark grayish brown very gravelly loam about 6 inches thick. The next layer is dark brown very gravelly clay loam about 11 inches thick. The upper 9 inches of the subsoil is dark brown extremely gravelly clay loam. The lower 10 inches is dark brown extremely gravelly silty clay. The depth to weathered bedrock is 20 to 40 inches.

Permeability is slow in the Derringer soil. Available water capacity is 2 to 5 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate or high.

The Harlow soil is shallow and well drained. It formed in colluvium derived from breccia, rhyolitic tuff, and argillite. Typically, the surface layer is very dark grayish brown extremely stony clay loam about 4 inches thick. The next layer is dark brown extremely gravelly clay loam about 8 inches thick. The subsoil is dark brown extremely cobbly clay about 6 inches thick. The depth to bedrock is 10 to 20 inches.

Permeability is slow in the Harlow soil. Available water capacity is 1 to 2 inches. The effective rooting depth is 10 to 20 inches. Runoff is medium, and the hazard of water erosion is moderate or high.

This unit is used mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on the Derringer soil is dominated by bluebunch wheatgrass, mountain big sagebrush, squaw apple, bitter cherry, and antelope bitterbrush.

Bluebunch wheatgrass is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 1,800 pounds per acre in favorable years and 1,000 pounds per acre in unfavorable years. Livestock access is limited by the rock fragments on the surface.

The potential plant community on the Harlow soil is dominated by bluebunch wheatgrass, mountain big sagebrush, squaw apple, and antelope bitterbrush.

Bluebunch wheatgrass is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 1,100 pounds per acre in favorable years and 500 pounds per acre in unfavorable years. Livestock access is limited by the rock fragments on the surface.

If the condition of the site deteriorates through overgrazing, bluebunch wheatgrass loses vigor and decreases in extent. Bitter cherry and antelope bitterbrush become decadent. Sandberg bluegrass, mountain big sagebrush, and perennial forbs increase in extent. If deterioration continues, cheatgrass, soft brome, and other annual plants invade the site.

Brush control on this unit is generally not advisable because of the value of palatable shrubs for wildlife.

The Derringer soil is in the Shrubby Mountain South 16-20pz range site. The Harlow soil is in the Mountain Shallow South 16-20pz range site.

43E—Dogtown complex, 35 to 55 percent north slopes. This map unit is on mountains. Areas are irregular in shape and are 200 to 800 acres in size. The native vegetation is mainly conifers, shrubs, and grasses. Elevation is 3,800 to 6,200 feet. The average annual precipitation is 20 to 30 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 30 to 50 days.

This unit is about 55 percent Dogtown gravelly loam and 35 percent Dogtown very stony loam. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of soils that are similar to the Dogtown soils but are less than 40 inches deep over weathered bedrock. Also included are small areas of Tolo soils and Rock outcrop. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Dogtown gravelly loam is deep and well drained. It formed in colluvium and residuum derived from quartz diorite and related granitic rocks and influenced by volcanic ash in the surface layer. Typically, the surface is covered with a mat of partially decomposed needles, grass, and moss about 2 inches thick. The surface layer is very dark grayish brown and dark brown gravelly loam about 11 inches thick. The subsoil is dark brown and brown very gravelly sandy loam about 30 inches thick. The substratum is brown very gravelly loamy sand about 26 inches thick. The depth to weathered bedrock is typically 60 inches or more.

Permeability is moderate to a depth of about 28 inches in Dogtown gravelly loam and moderately rapid below that depth. Available water capacity is 4 to 7 inches. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

Dogtown very stony loam is deep and well drained. It formed in colluvium and residuum derived from quartz diorite and related granitic rocks and influenced by volcanic ash in the surface layer. Typically, the surface is covered with a mat of partially decomposed needles, grass, and moss about 2 inches thick. The surface layer is very dark grayish brown very stony loam about 18 inches thick. The subsoil is dark brown very stony sandy loam about 13 inches thick. The substratum is brown extremely stony loamy sand about 23 inches thick. The depth to weathered bedrock is 40 to 60 inches.

Permeability is moderate to a depth of about 18 inches in Dogtown very stony loam and rapid below that depth. Available water capacity is 3 to 5 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 mainly for timber production. It also is used for livestock grazing, and it provides habitat for many kinds of wildlife.

Woodland.—This unit is suited to the production of Douglas-fir and ponderosa pine. The mean site index is 61 for Douglas-fir (50-year base age) and 83 for ponderosa pine (100-year base age). The potential production at culmination of the mean annual increment for Douglas-fir is 46 cubic feet per acre per year (3.2 cubic meters per hectare per year) in a 109-year-old, even-aged, fully stocked stand and for ponderosa pine is 74 cubic feet per acre per year (5.2 cubic meters per hectare per year) in a 40-year-old, even-aged, fully stocked stand.

The main concerns in producing and harvesting timber are the hazard of erosion, the equipment limitation, seedling mortality, and plant competition.

Minimizing the risk of erosion is essential in areas where timber is harvested. Properly designed road drainage systems that include carefully located culverts help to control erosion. Spoil from excavations is subject to rill and gully erosion and to sloughing. Roads, landings, skid trails, and firebreaks can be protected against erosion by constructing water bars and by seeding areas that have been cut and filled. Buffer strips may be needed in areas adjacent to perennial streams to minimize siltation and maintain stream temperatures.

The slope restricts the use of wheeled and tracked equipment on skid trails. High-lead or other logging systems that fully or partially suspend the logs above the ground will damage the soil less than tractor systems and reduce the risk of compaction. The risk of compaction also can be reduced by using suitable harvesting methods, laying out skid trails in advance, and harvesting timber when the soil is dry or frozen.

Careful management of reforestation is needed to minimize competition from undesirable plants. If the site is not adequately prepared, plant competition can prevent or delay reestablishment of volunteer or planted trees. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying. Scarification is severely restricted in the steeper areas because of increased expense and soil displacement.

The seedling mortality rate is increased by compaction of the surface layer because compaction limits the movement of water and air in the soil and restricts the growth of roots. The high content of rock fragments also limits seedling survival. To compensate for the higher expected mortality rate, larger seedlings or a greater number of seedlings than is typical can be planted. The trees that are suitable for planting include Douglas-fir and ponderosa pine.

Grazable woodland.—This unit is suitable for use as grazable woodland. The understory consists mainly of princes pine, low Oregongrape, myrtle pachystima, elk sedge, pinegrass, and heartleaf arnica.

A system that results in proper grazing use is an essential practice if livestock graze this unit. Timely deferment of grazing is needed to allow the desirable plants to mature and set seed. Grazing should be delayed in spring until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.

Seeding disturbed areas to suitable plants reduces the hazard of erosion and provides forage for livestock and wildlife. Deferred grazing is needed during periods when seedlings are becoming established.

These soils can produce adequate forage for big game animals after the tree canopy is opened by logging, fire, or some other disturbance. Dense stands of timber should be left in some areas to provide escape and thermal cover for the big game animals.

The Dogtown soils are in the Fir-Pine-Sedge woodland understory site.

44F—Dogtown very stony loam, 55 to 80 percent north slopes. This deep, well drained soil is on mountains. It formed in colluvium and residuum derived from quartz diorite and related granitic rocks and influenced by volcanic ash in the surface layer. Areas are irregular in shape and are 200 to 800 acres in size. The native vegetation is mainly conifers, shrubs, and grasses. Elevation is 3,800 to 6,200 feet. The average annual precipitation is 20 to 30 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 30 to 50 days.

Typically, the surface is covered with a mat of partially decomposed needles, grass, and moss about 2 inches thick. The surface layer is very dark grayish brown very stony loam about 18 inches thick. The subsoil is dark brown very stony sandy loam about 13 inches thick. The substratum is brown extremely stony loamy sand about 23 inches thick. The depth to weathered bedrock is 40 to 60 inches.

Included in this unit are small areas of soils that are similar to the Dogtown soil but are less than 40 inches deep over weathered bedrock. Also included are small areas of Rock outcrop. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate to a depth of about 18 inches in the Dogtown soil and rapid below that depth. Available water capacity is 3 to 5 inches. The effective rooting depth is 40 to 60 inches. Runoff is rapid, and the hazard of water erosion is very high.

This unit is used mainly for timber production. It also provides habitat for many kinds of wildlife.

Woodland.—This unit is suited to the production of Douglas-fir and ponderosa pine. The mean site index is 61 for Douglas-fir (50-year base age) and 83 for ponderosa pine (100-year base age). The potential production at culmination of the mean annual increment for Douglas-fir is 46 cubic feet per acre per year (3.2 cubic meters per hectare per year) in a 109-year-old, even-aged, fully stocked stand and for ponderosa pine is 74 cubic feet per acre per year (5.2 cubic meters per hectare per year) in a 40-year-old, even-aged, fully stocked stand.

The main concerns in producing and harvesting timber are the hazard of erosion, the equipment limitation, seedling mortality, and plant competition.

Minimizing the risk of erosion is essential in areas where timber is harvested. Properly designed road drainage systems that include carefully located culverts help to control erosion. Spoil from excavations is subject to rill and gully erosion and to sloughing. Roads and landings can be protected against erosion by constructing water bars and by seeding areas that have been cut and filled. Buffer strips may be needed in areas adjacent to perennial streams to minimize siltation and maintain stream temperatures.

The slope prevents the use of wheeled and tracked equipment. High-lead or other logging systems that fully suspend the logs above the ground will damage the soil less than other systems. The risk of compaction can be reduced by using suitable harvesting methods and by harvesting when the soil is dry or frozen.

Careful management of reforestation is needed to minimize competition from undesirable plants. If the site is not adequately prepared, plant competition can prevent or delay reestablishment of volunteer or planted trees. Competing weeds, brush, or trees can be controlled by spraying, cutting, or girdling.

The seedling mortality rate is increased by compaction of the surface layer because compaction limits the movement of water and air in the soil and restricts the growth of roots. The high content of rock fragments also limits seedling survival. To compensate for the higher expected mortality rate, larger seedlings or a greater number of seedlings than is typical can be planted. The trees that are suitable for planting include Douglas-fir and ponderosa pine.

The understory consists mainly of princes pine, low Oregongrape, myrtle pachystima, elk sedge, pinegrass, and heartleaf arnica.

This soil can produce adequate forage for big game animals after the tree canopy is opened by logging, fire, or some other disturbance. Dense stands of timber should be left in some areas to provide escape and thermal cover for the big game animals.

The Dogtown soil is in the Fir-Pine-Sedge woodland understory site.

45C—Durkee gravelly silt loam, 2 to 12 percent slopes. This moderately deep, well drained soil is on hills. It formed in colluvium derived from argillite and influenced by loess and volcanic ash in the upper part. Areas are long and rectangular and are 20 to 200 acres in size. The native vegetation is mainly bunchgrasses, shrubs, and forbs. Elevation is 3,600 to 5,000 feet. The average annual precipitation is 12 to 16 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 50 to 110 days.

Typically, the surface layer is very dark grayish brown gravelly silt loam about 7 inches thick. The next layer is very dark grayish brown clay loam about 3 inches thick. The upper 7 inches of the subsoil is dark brown and dark yellowish brown clay. The lower 5 inches is brown silty clay loam. The depth to bedrock is 20 to 40 inches.

Included in this unit are small areas of soils that are similar to the Durkee soil but are less than 20 inches deep over bedrock. Also included are small areas of Ateron soils. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate to a depth of about 10 inches in the Durkee soil and slow below that depth. Available water capacity is 3 to 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 mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on this unit is dominated by Idaho fescue and mountain big sagebrush.

Idaho fescue is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 2,000 pounds per acre in favorable years and 1,000 pounds per acre in unfavorable years.

If the condition of the site deteriorates through overgrazing, Idaho fescue loses vigor and decreases in extent. Mountain big sagebrush, basin big sagebrush, bluebunch wheatgrass, and Sandberg bluegrass increase in extent. If deterioration continues, the extent of bluebunch wheatgrass decreases, the extent of big sagebrush strongly increases, and unpalatable forbs and annuals invade the site.

The Durkee soil is in the Mountain Clayey 12-16pz range site.

46D—Durkee gravelly silt loam, 12 to 35 percent north slopes. This moderately deep, well drained soil is on hills. It formed in colluvium derived from argillite and influenced by loess and volcanic ash in the upper part. Areas are irregular in shape and are 40 to 400 acres in size. The native vegetation is mainly bunchgrasses, shrubs, and forbs. Elevation is 3,600 to 5,000 feet. The average annual precipitation is 12 to 16 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 50 to 110 days.

Typically, the surface layer is very dark grayish brown gravelly silt loam about 7 inches thick. The next layer is very dark grayish brown clay loam about 3 inches thick. The upper 7 inches of the subsoil is dark brown and dark yellowish brown clay. The lower 5 inches is brown silty clay loam. The depth to bedrock is 20 to 40 inches.

Included in this unit are small areas of soils that are similar to the Durkee soil but are more than 40 inches deep over bedrock. Also included are small areas of Ateron and Snell soils. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate to a depth of about 10 inches in the Durkee soil and slow below that depth. Available water capacity is 3 to 5 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 mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on

this unit is dominated by Idaho fescue and squaw apple.

Idaho fescue is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 2,200 pounds per acre in favorable years and 1,000 pounds per acre in unfavorable years.

If the condition of the site deteriorates through overgrazing, Idaho fescue loses vigor and decreases in extent. Mountain big sagebrush and bluebunch wheatgrass increase in extent. Bluegrasses invade. If deterioration continues, the extent of bluebunch wheatgrass decreases, the extent of mountain big sagebrush strongly increases, and annual grasses and forbs invade the site.

The Durkee soil is in the Mountain North 12-16pz range site.

46E—Durkee gravelly silt loam, 35 to 60 percent north slopes. This moderately deep, well drained soil is on hills. It formed in colluvium derived from argillite and influenced by loess and volcanic ash in the upper part. Areas are irregular in shape and are 40 to 400 acres in size. The native vegetation is mainly bunchgrasses, shrubs, and forbs. Elevation is 3,600 to 5,000 feet. The average annual precipitation is 12 to 16 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 50 to 110 days.

Typically, the surface layer is very dark grayish brown gravelly silt loam about 7 inches thick. The next layer is very dark grayish brown clay loam about 3 inches thick. The upper 7 inches of the subsoil is dark brown and dark yellowish brown clay. The lower 5 inches is brown silty clay loam. The depth to bedrock is 20 to 40 inches.

Included in this unit are small areas of soils that are similar to the Durkee soil but are more than 40 inches deep over bedrock. Also included are small areas of Ateron and Snell soils. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate to a depth of about 10 inches in the Durkee soil and slow below that depth. Available water capacity is 3 to 5 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high or very high.

This unit is used mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on this unit is dominated by Idaho fescue and squaw apple.

Idaho fescue is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 2,200 pounds per acre in favorable years and 1,000 pounds per acre in unfavorable years. Livestock access is limited by the slope.

If the condition of the site deteriorates through overgrazing, Idaho fescue loses vigor and decreases in extent. Mountain big sagebrush and bluebunch wheatgrass increase in extent. If deterioration continues, the extent of bluebunch wheatgrass decreases, the extent of mountain big sagebrush strongly increases, and annual grasses and forbs invade the site. Unpalatable annual grasses, forbs, and shrubs increase in extent.

Mechanical treatment is not practical because of the slope.

The Durkee soil is in the Mountain North 12-16pz range site.

47D—Durkee gravelly silt loam, 12 to 35 percent south slopes. This moderately deep, well drained soil is on hills. It formed in colluvium derived from argillite and influenced by loess and volcanic ash in the upper part. Areas are irregular in shape and are 40 to 400 acres in size. The native vegetation is mainly bunchgrasses, shrubs, and forbs. Elevation is 3,600 to 5,000 feet. The average annual precipitation is 12 to 16 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 50 to 110 days.

Typically, the surface layer is very dark grayish brown gravelly silt loam about 7 inches thick. The next layer is very dark grayish brown clay loam about 3 inches thick. The upper 7 inches of the subsoil is dark brown and dark yellowish brown clay. The lower 5 inches is brown silty clay loam. The depth to bedrock is 20 to 40 inches.

Included in this unit are small areas of soils that are similar to the Durkee soil but are less than 20 inches deep over bedrock. Also included are small areas of Ateron soils. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate to a depth of about 10 inches in the Durkee soil and slow below that depth. Available water capacity is 3 to 5 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 mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on this unit is dominated by bluebunch wheatgrass, Idaho fescue, mountain big sagebrush, and squaw apple.

Bluebunch wheatgrass and Idaho fescue are the major forage-producing plants. If the site is in excellent condition, the total annual production is estimated at

1,400 pounds per acre in favorable years and 700 pounds per acre in unfavorable years.

If the condition of the site deteriorates through overgrazing, bluebunch wheatgrass and Idaho fescue lose vigor and decrease in extent. Big sagebrush and Sandberg bluegrass increase in extent. If deterioration continues, annual grasses and forbs invade the site.

The Durkee soil is in the Mountain South 12-16pz range site.

47E—Durkee gravelly silt loam, 35 to 60 percent south slopes. This moderately deep, well drained soil is on hills. It formed in colluvium derived from argillite and influenced by loess and volcanic ash in the upper part. Areas are irregular in shape and are 40 to 400 acres in size. The native vegetation is mainly bunchgrasses, shrubs, and forbs. Elevation is 3,600 to 5,000 feet. The average annual precipitation is 12 to 16 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 50 to 110 days.

Typically, the surface layer is very dark grayish brown gravelly silt loam about 7 inches thick. The next layer is very dark grayish brown clay loam about 3 inches thick. The upper 7 inches of the subsoil is dark brown and dark yellowish brown clay. The lower 5 inches is brown silty clay loam. The depth to bedrock is 20 to 40 inches.

Included in this unit are small areas of soils that are similar to the Durkee soil but are less than 20 inches deep over bedrock. Also included are small areas of Ateron soils. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate to a depth of about 10 inches in the Durkee soil and slow below that depth. Available water capacity is 3 to 5 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high or very high.

This unit is used mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on this unit is dominated by bluebunch wheatgrass, Idaho fescue, mountain big sagebrush, and squaw apple.

Bluebunch wheatgrass and Idaho fescue are the major forage-producing plants. If the site is in excellent condition, the total annual production is estimated at 1,400 pounds per acre in favorable years and 700 pounds per acre in unfavorable years. Livestock access is limited by the slope.

If the condition of the site deteriorates through overgrazing, bluebunch wheatgrass and Idaho fescue lose vigor and decrease in extent. Big sagebrush and Sandberg bluegrass increase in extent. If deterioration continues, annual grasses and forbs invade the site.

Mechanical treatment is not practical because of the slope.

The Durkee soil is in the Mountain South 12-16pz range site.

48F—Eaglecap very stony loam, 30 to 80 percent north slopes. This deep, well drained soil is on mountains. It formed in colluvium and residuum derived from quartz diorite and related granitic rocks and influenced by volcanic ash in the surface layer. Areas are irregular in shape and are 200 to 800 acres in size. The native vegetation is mainly conifers, shrubs, and forbs. Elevation is 6,200 to 8,500 feet. The average annual precipitation is 30 to 40 inches, the average annual air temperature is 35 to 40 degrees F, and the average frost-free period is 20 to 40 days.

Typically, the surface is covered with a mat of partially decomposed needles, grass, and moss about 1 inch thick. The surface layer is very dark brown and brown very stony loam about 16 inches thick. The subsoil is brown very cobbly sandy loam about 12 inches thick. The substratum is brown and yellowish brown extremely cobbly loamy sand about 32 inches thick. The depth to bedrock is typically more than 60 inches but is 40 to 60 inches in some areas.

Included in this unit are small areas of soils that are similar to the Eaglecap soil but are less than 40 inches deep over weathered bedrock. Also included are small areas of Rock outcrop. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate to a depth of about 16 inches in the Eaglecap soil and moderately rapid below that depth. Available water capacity is 3 to 6 inches. The effective rooting depth is typically more than 60 inches but is 40 to 60 inches in some areas. Runoff is rapid, and the hazard of water erosion is high or very high.

The Eaglecap soil is used mainly for timber production and for water supply. It also provides habitat for many kinds of wildlife.

Woodland.—This unit is suited to the production of subalpine fir and western larch. The mean site index is 59 for subalpine fir (100-year base age) and 38 for western larch (50-year base age). The potential production at culmination of the mean annual increment is 49 cubic feet per acre per year (3.4 cubic meters per hectare per year) in a 120-year-old, even-aged, fully stocked stand and for western larch is 43 cubic feet per acre per year (3.0 cubic meters per hectare per year) in a 70-year-old, even-aged, fully stocked stand.

The main concerns in producing and harvesting timber are the hazard of erosion, the equipment limitation, seedling mortality, plant competition, and fire damage to the soil.

Minimizing the risk of erosion is essential in areas where timber is harvested. Properly designed road drainage systems that include carefully located culverts help to control erosion. Spoil from excavations is subject to rill and gully erosion and to sloughing. Roads and landings can be protected against erosion by constructing water bars and by seeding areas that have been cut and filled. Buffer strips may be needed in areas adjacent to perennial streams to minimize siltation and maintain stream temperatures.

The slope prevents the use of wheeled and tracked equipment. High-lead or other logging systems that fully suspend the logs above the ground will damage the soil less than other systems. The risk of compaction can be reduced by using suitable harvesting methods and by harvesting when the soil is dry or frozen.

Droughtiness in the surface layer and the high content of rock fragments increase the seedling mortality rate. To compensate for the higher expected mortality rate, larger seedlings or a greater number of seedlings than is typical can be planted. The trees that are suitable for planting include Engelmann spruce, lodgepole pine, and western larch.

Careful management of reforestation is needed to minimize competition from undesirable plants. If the site is not adequately prepared, plant competition can prevent or delay reestablishment of volunteer or planted trees. Competing weeds, brush, or trees can be controlled by spraying, cutting, or girdling.

Some decline in forest productivity may result from fire of moderate intensity.

The understory consists mainly of grouse blueberry, princes pine, myrtle pachystima, elk sedge, pyrola, and heartleaf arnica.

This soil can produce adequate forage for big game animals after the tree canopy is opened by logging, fire, or some other disturbance. Dense stands of timber should be left in some areas to provide escape and thermal cover for the big game animals.

The Eaglecap soil is in the Subalpine Fir-Grouse Blueberry woodland understory site.

49D—Emily silt loam, 12 to 35 percent north slopes. This deep, well drained soil is on foot slopes and mountain side slopes. It formed in colluvium derived from basalt and influenced by loess and volcanic ash in the surface layer. Areas are irregular in shape and are 40 to 100 acres in size. The native vegetation is mainly conifers, shrubs, and grasses. Elevation is 2,000 to 3,300 feet. The average annual precipitation is 20 to 24 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 100 to 120 days.

Typically, the surface layer is covered with a mat of partially decomposed needles, leaves, and twigs about 3 inches thick. The surface layer is very dark brown and very dark grayish brown silt loam about 8 inches thick. The upper part of the subsoil is dark brown very cobbly silty clay loam about 21 inches thick. The lower part is dark yellowish brown very cobbly clay loam about 31 inches thick. The depth to bedrock is typically more than 60 inches but is 40 to 60 inches in some areas.

Included in this unit are small areas of Copperfield soils. Also included are small areas of Sag and Snell soils and Rock outcrop. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate in the Emily soil. Available water capacity is 4 to 7 inches. The effective rooting depth is typically more than 60 inches but is 40 to 60 inches in some areas. Runoff is medium, and the hazard of water erosion is moderate or high.

This unit is used mainly for timber production. It also is used for livestock grazing, and it provides habitat for many kinds of wildlife.

Woodland.—This unit is suited to the production of ponderosa pine. The mean site index is 102 for ponderosa pine (100-year base age). The potential production at culmination of the mean annual increment for ponderosa pine is 106 cubic feet per acre per year (7.4 cubic meters per hectare per year) in a 40-year-old, even-aged, fully stocked stand.

The main concerns in producing and harvesting timber are the hazard of erosion, the equipment limitation, seedling mortality, plant competition, and fire damage to the soil.

Minimizing the risk of erosion is essential in areas where timber is harvested. Properly designed road drainage systems that include carefully located culverts help to control erosion. Spoil from excavations is subject to rill and gully erosion and to sloughing. Roads, landings, skid trails, and firebreaks can be protected against erosion by constructing water bars and by seeding areas that have been cut and filled. Buffer strips may be needed in areas adjacent to perennial streams to minimize siltation and maintain stream temperatures.

Using standard wheeled or tracked equipment when the soil is moist causes rutting and compaction. Displacement of the surface layer occurs most readily when the soil is dry. The risk of compaction can be reduced by using low-pressure ground equipment, laying out skid trails in advance, and harvesting timber when the soil is dry or frozen. Cable yarding systems that partially or fully suspend logs generally do less damage to the soil than conventional ground-based systems.

Careful management of reforestation is needed to minimize competition from undesirable plants. If the site is not adequately prepared, plant competition can prevent or delay reestablishment of volunteer or planted trees. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying.

The seedling mortality rate is increased by compaction of the surface layer because compaction limits the movement of water and air in the soil and restricts the growth of roots. The high content of rock fragments also limits seedling survival. To compensate for the higher expected mortality rate, larger seedlings or a greater number of seedlings than is typical can be planted. The trees that are suitable for planting include Douglas-fir and western larch.

Some decline in forest productivity may result from fire of moderate intensity.

Grazable woodland.—This unit is suitable for use as grazable woodland. The understory is dominated by mallow ninebark, creambush oceanspray, spirea, elk sedge, pinegrass, and brackenfern. The potential production of the native understory plants in a normal year is about 900 pounds of air-dry forage per acre.

A system that results in proper grazing use is essential if livestock graze this unit. Timely deferment of grazing is needed to allow the desirable plants to mature and set seed. Grazing should be delayed in spring until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.

Seeding disturbed areas to suitable plants reduces the hazard of erosion and provides forage for livestock and wildlife. Deferred grazing is needed during periods when seedlings are becoming established.

This soil can produce adequate forage for big game animals after the tree canopy is opened by logging, fire, or some other disturbance. Stands of timber should be left in some areas to provide escape and thermal cover for the big game animals.

The Emily soil is in the Pine-Ninebark-Sedge woodland understory site.

49E—Emily silt loam, 35 to 60 percent north slopes. This deep, well drained soil is on foot slopes and mountain side slopes. It formed in colluvium derived from basalt and influenced by loess and volcanic ash in the surface layer. Areas are irregular in shape and are 40 to 100 acres in size. The native vegetation is mainly conifers, shrubs, and grasses. Elevation is 2,000 to 3,300 feet. The average annual precipitation is 20 to 24 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 100 to 120 days.

Typically, the surface layer is covered with a mat of partially decomposed needles, leaves, and twigs about 3 inches thick. The surface layer is very dark brown and very dark grayish brown silt loam about 8 inches thick. The upper part of the subsoil is dark brown very cobbly silty clay loam about 21 inches thick. The lower part is dark yellowish brown very cobbly clay loam about 31 inches thick. The depth to bedrock is typically more than 60 inches but is 40 to 60 inches in some areas.

Included in this unit are small areas of Rock outcrop and Copperfield soils. Also included are small areas of Sag and Snell soils. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Emily soil. Available water capacity is 4 to 7 inches. The effective rooting depth is typically more than 60 inches but is 40 to 60 inches in some areas. Runoff is rapid, and the hazard of water erosion is high or very high.

This unit is used mainly for timber production. It also is used for livestock grazing, and it provides habitat for many kinds of wildlife.

Woodland.—This unit is suited to the production of ponderosa pine. The mean site index is 102 for ponderosa pine (100-year base age). The potential production at culmination of the mean annual increment for ponderosa pine is 106 cubic feet per acre per year (7.4 cubic meters per hectare per year) in a 40-year-old, even-aged, fully stocked stand.

The main concerns in producing and harvesting timber are the hazard of erosion, the equipment limitation, seedling mortality, plant competition, and fire damage to the soil.

Minimizing the risk of erosion is essential in areas where timber is harvested. Properly designed road drainage systems that include carefully located culverts help to control erosion. Spoil from excavations is subject to rill and gully erosion and to sloughing. Roads, landings, skid trails, and firebreaks can be protected against erosion by constructing water bars and by seeding areas that have been cut and filled. Buffer strips may be needed in areas adjacent to perennial streams to minimize siltation and maintain stream temperatures.

The slope restricts the use of wheeled and tracked equipment on skid trails. High-lead or other logging systems that fully or partially suspend the logs above the ground will damage the soil less than tractor systems and reduce the risk of compaction. The risk of compaction can be reduced further by using suitable harvesting methods, laying out skid trails in advance, and harvesting timber when the soil is dry or frozen.

Careful management of reforestation is needed to minimize competition from undesirable plants. If the site is not adequately prepared, plant competition can prevent or delay reestablishment of volunteer or planted trees. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying. Scarification is severely restricted in the steeper areas because of increased expense and soil displacement.

The seedling mortality rate is increased by compaction of the surface layer because compaction limits the movement of water and air in the soil and restricts the growth of roots. The high content of rock fragments also limits seedling survival. To compensate for the higher expected mortality rate, larger seedlings or a greater number of seedlings than is typical can be planted. The trees that are suitable for planting include ponderosa pine.

Some decline in forest productivity may result from fire of moderate intensity.

Grazable woodland.—This unit is suitable for use as grazable woodland. The understory is dominated by mallow ninebark, creambush oceanspray, spirea, elk sedge, pinegrass, and brackenfern. The potential production of the native understory plants in a normal year is about 900 pounds of air-dry forage per acre.

A system that results in proper grazing use is essential if livestock graze this unit. Timely deferment of grazing is needed to allow the desirable plants to mature and set seed. Grazing should be delayed in spring until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.

Seeding disturbed areas to suitable plants reduces the hazard of erosion and provides forage for livestock and wildlife. Deferred grazing is needed during periods when seedlings are becoming established.

This soil can produce adequate forage for big game animals after the tree canopy is opened by logging, fire, or some other disturbance. Stands of timber should be left in some areas to provide escape and thermal cover for the big game animals.

The Emily soil is in the Pine-Ninebark-Sedge woodland understory site.

50C—Encina gravelly silt loam, 2 to 12 percent slopes. This deep, well drained soil is on terraces. It formed in mixed lacustrine sediments. Areas are irregular in shape and are 40 to 200 acres in size. The native vegetation is mainly bunchgrasses, forbs, and shrubs. Elevation is 2,800 to 3,800 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 110 to 130 days.

Typically, the surface layer is very dark grayish brown gravelly silt loam about 4 inches thick. The next layer is dark brown clay loam about 3 inches thick. The upper part of the subsoil is dark brown clay about 5 inches thick. The lower part is about 30 inches of dark yellowish brown and grayish brown, calcareous silty clay loam and silt loam. The substratum to a depth of 60 inches or more is multicolored extremely gravelly loam.

Included in this unit are small areas of Poall and Virtue soils. Also included are small areas of soils that are similar to the Encina soil but have cobbles on the surface. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate to a depth of about 4 inches in the Encina soil and slow below that depth. Available water capacity is 7 to 10 inches. The effective rooting depth is limited by the weakly cemented, extremely gravelly substratum at 40 to 60 inches. Runoff is slow or medium, and the hazard of water erosion is slight or moderate.

This unit is used mainly for livestock grazing. It also is used for irrigated hay and pasture, and it provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on this unit is dominated by Idaho fescue and Wyoming big sagebrush.

Idaho fescue is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 1,500 pounds per acre in favorable years and 500 pounds per acre in unfavorable years.

If the condition of the site deteriorates through overgrazing, Idaho fescue loses vigor and decreases in extent. Wyoming big sagebrush, bluebunch wheatgrass, and Sandberg bluegrass increase in extent. If deterioration continues, the extent of bluebunch wheatgrass decreases and unpalatable annual grasses and forbs invade the site.

Hay and pasture.—This unit is suited to irrigated hay and pasture.

Management that maintains the optimum vigor and quality of forage plants is needed. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and control erosion. Periodic mowing and clipping help to maintain uniform growth and prevent selective grazing.

In summer irrigation is needed for the maximum production of hay. Sprinkler irrigation is a suitable method of applying water. It permits the even, controlled application of water, helps to control runoff, and minimizes the risk of erosion. To avoid 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.

Fertilizer is needed to ensure the optimum growth of grasses and legumes. A cropping system that includes grasses, legumes, or grass-legume mixtures helps to maintain soil fertility and tilth.

Conducting fieldwork during wet periods results in deterioration of tilth and destroys soil structure. As a result, it increases the runoff rate and the hazard of erosion. Runoff and erosion can be controlled by crop residue management and by rough or minimum tillage or stubble-mulching. All tillage should be on the contour or across the slope.

Grazing during wet periods results in compaction of the surface layer, poor tilth, and excessive runoff. Compaction limits the movement of air and water in the soil and restricts the growth of roots.

A wide variety of trees and shrubs can be grown as windbreaks and environmental plantings on this soil. Seedling mortality is severe because the high content of clay causes moisture stress in the seedlings. Cultivation or applications of herbicide help to remove competing vegetation.

The Encina soil is in the Mountain Clayey 9-12pz range site.

51D—Encina gravelly silt loam, 12 to 35 percent south slopes. This deep, well drained soil is on terraces. It formed in mixed lacustrine sediments. Areas are irregular in shape and are 40 to 200 acres in size. The native vegetation is mainly bunchgrasses, forbs, and shrubs. Elevation is 2,800 to 3,800 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 110 to 130 days.

Typically, the surface layer is very dark grayish brown gravelly silt loam about 4 inches thick. The next layer is dark brown clay loam about 3 inches thick. The upper part of the subsoil is dark brown clay about 5 inches thick. The lower part is about 30 inches of dark yellowish brown and grayish brown, calcareous silty clay loam and silt loam. The substratum to a depth of 60 inches or more is multicolored extremely gravelly loam.

Included in this unit are small areas of Poall and Legler soils. Also included are small areas of soils that are similar to the Encina soil but have cobbles on the surface. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate to a depth of about 4 inches in the Encina soil and slow below that depth. Available water capacity is 7 to 10 inches. The effective rooting depth is limited by the weakly cemented, extremely gravelly substratum at 40 to 60 inches. Runoff is medium, and the hazard of water erosion is moderate or high.

This unit is used mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on this unit is dominated by bluebunch wheatgrass and Wyoming big sagebrush.

Bluebunch wheatgrass is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 1,200 pounds per acre in favorable years and 400 pounds per acre in unfavorable years.

If the condition of the site deteriorates through overgrazing, bluebunch wheatgrass loses vigor and decreases in extent. Sandberg bluegrass and Wyoming big sagebrush increase in extent. If deterioration continues, annual grasses and forbs invade the site.

The Encina soil is in the Clayey South 9-12pz range site.

51E—Encina gravelly silt loam, 35 to 50 percent south slopes. This deep, well drained soil is on terraces. It formed in mixed lacustrine sediments. Areas are irregular in shape and are 40 to 200 acres in size. The native vegetation is mainly bunchgrasses, forbs, and shrubs. Elevation is 2,800 to 3,800 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 110 to 130 days.

Typically, the surface layer is very dark grayish brown gravelly silt loam about 4 inches thick. The next layer is dark brown clay loam about 3 inches thick. The upper part of the subsoil is dark brown clay about 5 inches thick. The lower part is about 30 inches of dark yellowish brown and grayish brown, calcareous silty clay loam and silt loam. The substratum to a depth of 60 inches or more is multicolored extremely gravelly loam.

Included in this unit are small areas of Poall and Hyall soils. Also included are small areas of soils that are similar to the Encina soil but have cobbles on the surface and small areas of Badland. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate to a depth of about 4 inches in the Encina soil and slow below that depth. Available water capacity is 7 to 10 inches. The effective rooting depth is limited by the weakly cemented, extremely gravelly substratum at 40 to 60 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on this unit is dominated by bluebunch wheatgrass and Wyoming big sagebrush.

Bluebunch wheatgrass is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 1,200 pounds per acre in favorable years and 400 pounds per acre in unfavorable years. Livestock access is limited by the slope.

If the condition of the site deteriorates through overgrazing, bluebunch wheatgrass loses vigor and decreases in extent. Sandberg bluegrass and Wyoming big sagebrush increase in extent. If deterioration continues, annual grasses and forbs invade the site.

Mechanical treatment is not practical because of the slope.

The Encina soil is in the Clayey South 9-12pz range site.

52E—Fivebit-Rock outcrop complex, 35 to 60 percent south slopes. This map unit is on mountains. Areas are irregular in shape and are 80 to 200 acres in size. The native vegetation is mainly scattered trees, shrubs, grasses, and forbs. Elevation is 4,400 to 6,000 feet. The average annual precipitation is 16 to 30 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 50 to 90 days.

This unit is about 55 percent Fivebit extremely stony loam 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 selected scale.

Included in this unit are small areas of Anatone and Harlow soils. Also included are small areas of Sisley soils. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Fivebit soil is shallow and well drained. It formed in colluvium derived from andesite and basalt. Typically, the surface is covered with a mat of partially decomposed needles, leaves, and twigs about 0.5 inch thick. The surface layer is very dark grayish brown extremely stony loam about 3 inches thick. The next layer is very dark grayish brown very gravelly loam about 9 inches thick. The subsoil is dark brown extremely gravelly clay loam about 6 inches thick. The depth to bedrock is 10 to 20 inches.

Permeability is moderately slow in the Fivebit soil. Available water capacity is 1 to 3 inches. The effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is high or very high.

This unit is used mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on the Fivebit soil is dominated by curlleaf mountainmahogany, bluebunch wheatgrass, western juniper, and antelope bitterbrush.

Bluebunch wheatgrass is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 1,300 pounds per acre in favorable years and 600 pounds per acre in unfavorable years. Livestock access is limited by the slope, the Rock outcrop, and the stones on the surface.

If the condition of the site deteriorates through overgrazing, curlleaf mountainmahogany, bluebunch wheatgrass, and antelope bitterbrush lose vigor and decrease in extent. Western juniper, mountain big sagebrush, and Sandberg bluegrass increase in extent. If deterioration continues, annual grasses and forbs invade the site.

Brush control is not advisable because of the value of palatable shrubs on this unit for wildlife.

The Fivebit soil is in the Mahogany Rockland 12+pz range site.

53B—Glasgow silt loam, 2 to 7 percent slopes. This moderately deep, well drained soil is on hills. It formed in colluvium derived from volcanic tuff and influenced by loess and volcanic ash in the surface layer. Areas are irregular in shape and are 20 to 200 acres in size. The native vegetation is mainly bunchgrasses, shrubs, and forbs. Elevation is 2,400 to 3,400 feet. The average annual precipitation is 10 to 12 inches, the average annual air temperature is 47 to 50 degrees F, and the average frost-free period is 90 to 130 days.

Typically, the surface layer is very dark grayish brown silt loam about 6 inches thick. The next layer is dark grayish brown silt loam about 6 inches thick. The upper 4 inches of the subsoil is dark brown clay. The lower 8 inches is dark yellowish brown clay loam. The depth to fractured bedrock is 20 to 40 inches.

Included in this unit are small areas of Brownscombe and Greenscombe soils. Also included are small areas of soils that are similar to the Glasgow soil but are less than 20 inches deep over bedrock. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate to a depth of about 12 inches in the Glasgow soil and slow below that depth. Available water capacity is 3 to 5 inches. The effective rooting depth is 20 to 40 inches. Runoff is slow, and the hazard of water erosion is slight or moderate.

This unit is used mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on this unit is dominated by Idaho fescue and Wyoming big sagebrush.

Idaho fescue is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 1,500 pounds per acre in favorable years and 500 pounds per acre in unfavorable years.

If the condition of the site deteriorates through overgrazing, Idaho fescue loses vigor and decreases in extent. Wyoming big sagebrush, bluebunch wheatgrass, and Sandberg bluegrass increase in extent. If deterioration continues, the extent of bluebunch wheatgrass decreases, the extent of Sandberg bluegrass and Wyoming big sagebrush strongly increases, and annual grasses and forbs invade the site.

The Glasgow soil is in the Mountain Clayey 9-12pz range site.

54B—Goodrich gravelly loam, 0 to 7 percent slopes. This deep, well drained soil is on alluvial fans. It formed in mixed alluvium. Areas are irregular in shape and are 40 to 200 acres in size. The native vegetation is mainly bunchgrasses, forbs, and shrubs. Elevation is 3,400 to 3,800 feet. The average annual precipitation is 12 to 16 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 130 days.

Typically, the surface layer is very dark grayish brown gravelly loam about 12 inches thick. The upper part of the substratum is dark brown gravelly loam about 13 inches thick. The lower part to a depth of 60 inches or more is dark brown and dark grayish brown very gravelly loam and very gravelly sandy loam.

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

Permeability is moderate to a depth of about 40 inches in the Goodrich soil and moderately rapid below that depth. Available water capacity is 4 to 6 inches. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight or moderate.

This unit is used mainly for irrigated hay and pasture or small grain. It also is used for homesite development, and it provides habitat for many kinds of wildlife.

Hay and pasture or cropland.—If this unit is used for irrigated hay and pasture or crops, the main limitation is droughtiness.

Management that maintains the optimum vigor and quality of forage plants is needed. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and control erosion. Periodic mowing and clipping help to maintain uniform growth and prevent selective grazing.

In summer irrigation is needed for the maximum production of most crops. Irrigation water can be applied by sprinklers. This permits the even, controlled application of water, helps to control runoff, and minimizes the risk of erosion. To avoid 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.

Fertilizer is needed to ensure the optimum growth of grasses, legumes, and other crops. Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain soil fertility and tilth.

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

Conducting fieldwork during wet periods results in deterioration of tilth and destroys soil structure. As a result, it increases the runoff rate and the hazard of erosion. Runoff and erosion can be controlled by managing residues, using rough or minimum tillage, or stubble-mulching. All tillage should be on the contour or across the slope.

Grazing during wet periods results in compaction of the surface layer, poor tilth, and excessive runoff. Compaction limits the movement of air and water in the soil and restricts the growth of roots.

The trees and shrubs grown as windbreaks and environmental plantings should be those that are tolerant of droughty conditions. A low available water capacity causes moderate seedling mortality. Continued cultivation, mulching, or applications of herbicide to control competing vegetation are needed to ensure the establishment and survival of seedlings. Irrigation may be needed when the trees and shrubs are planted and during dry periods.

Homesite development.—If this unit is used for homesite development, the main limitation is a moderate potential for frost action. Properly designing foundations, footings, and roads helps to offset the moderate potential for frost action.

The Goodrich soil is in the Mountain Loamy 12-16pz range site.

55B—Goodrich-Benderly complex, 0 to 7 percent slopes. This map unit is on alluvial fans. Areas are irregular in shape and are 20 to 200 acres in size. The native vegetation is mainly bunchgrasses, forbs, and shrubs. Elevation is 3,400 to 3,800 feet. The average annual precipitation is 12 to 16 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 130 days.

This unit is about 50 percent Goodrich gravelly loam and 35 percent Benderly gravelly fine sandy loam. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of Wingville soils. Also included are small areas of soils that are similar to the Benderly soil but have cobbles on the surface or are less than 10 inches deep to the extremely gravelly substratum. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Goodrich soil is deep and well drained. It formed in mixed alluvium. Typically, the surface layer is very dark grayish brown gravelly loam about 12 inches thick. The upper part of the substratum is dark brown gravelly loam about 13 inches thick. The lower part to a depth of 60 inches or more is dark brown and dark grayish brown very gravelly loam and very gravelly sandy loam.

Permeability is moderate to a depth of about 40 inches in the Goodrich soil and moderately rapid below that depth. Available water capacity is 4 to 6 inches. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight or moderate.

The Benderly soil is deep and somewhat excessively drained. It formed in mixed alluvium. Typically, the surface layer is very dark grayish brown and dark brown gravelly fine sandy loam about 16 inches thick. The substratum to a depth of 60 inches or more is extremely gravelly sand. Depth to the extremely gravelly substratum is 10 to 20 inches.

Permeability is rapid in the Benderly soil. Available water capacity is 2 to 4 inches. The effective rooting depth is 10 to 20 inches. Runoff is slow, and the hazard of water erosion is slight or moderate.

This unit is used mainly for livestock grazing. It also is used for homesite development, and it provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on this unit is dominated by Idaho fescue and mountain big sagebrush.

Idaho fescue is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 1,800 pounds per acre in favorable years and 1,000 pounds per acre in unfavorable years.

If the condition of the site deteriorates through overgrazing, Idaho fescue and bluebunch wheatgrass lose vigor and decrease in extent. Needlegrass, threadleaf sedge, mountain big sagebrush, and Sandberg bluegrass increase in extent. If deterioration continues, the extent of needlegrass and threadleaf sedge decreases, the extent of big sagebrush strongly increases, and unpalatable forbs and annuals invade the site.

Livestock watering ponds are not practical because of the hazard of seepage.

Homesite development.—If this unit is used for homesite development, the main limitations are the rapid permeability and sandy substratum in the Benderly soil and a moderate potential for frost action in the Goodrich soil.

Septic tank absorption fields should be installed in areas of the Goodrich soil rather than in areas of the Benderly soil. The effluent can contaminate ground water in areas of the Benderly soil. If the density of housing is moderate or high, community sewage systems are needed to prevent the contamination of water resulting from seepage. In areas of the Benderly soil, retainer walls should be constructed in shallow excavations to keep cutbanks from caving in. Properly designing foundations, footings, and roads helps to offset the moderate potential for frost action in the Goodrich soil.

The Goodrich and Benderly soils are in the Mountain Loamy 12-16pz range site.

56C—Greenscombe loam, 2 to 12 percent slopes. This moderately deep, well drained soil is on hills. It formed in colluvium derived from quartz diorite and related granitic rocks. Areas are irregular in shape and are 40 to 200 acres in size. The native vegetation is mainly bunchgrasses, forbs, and shrubs. Elevation is 3,200 to 3,800 feet. The average annual precipitation is 12 to 16 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 130 days.

Typically, the surface layer is very dark grayish brown and dark brown loam about 11 inches thick. The subsoil is dark yellowish brown sandy clay loam about 8 inches thick. The substratum is dark yellowish brown sandy clay loam and gravelly sandy loam. It extends to a depth of about 30 inches. The depth to weathered bedrock is 20 to 40 inches.

Included in this unit are small areas of Ridley and Keating soils. Also included are small areas of soils that are similar to the Greenscombe soil but are more than 40 inches deep over weathered bedrock. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate in the Greenscombe soil. Available water capacity is 4 to 6 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 mainly for livestock grazing. It also provides habitat for many kinds of wildlife. A few areas are used for dryland small grain.

Livestock grazing.—The potential plant community on

this unit is dominated by Idaho fescue and mountain big sagebrush.

Idaho fescue is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 1,800 pounds per acre in favorable years and 1,000 pounds per acre in unfavorable years.

If the condition of the site deteriorates through overgrazing, Idaho fescue loses vigor and decreases in extent. Needlegrass, bluebunch wheatgrass, threadleaf sedge, Sandberg bluegrass, and mountain big sagebrush increase in extent. If deterioration continues, the extent of bluebunch wheatgrass, threadleaf sedge, and needlegrass decreases, the extent of big sagebrush strongly increases, and unpalatable forbs and annuals invade the site.

Crops.—If this unit is used for dryland small grain, the main management concern is the moderate hazard of erosion in the steeper areas.

The main needs in crop management are to protect the soil from water erosion and to conserve soil moisture for plant growth. Practices that can be used to control erosion include early fall seeding, stubble-mulching or no-till, and construction of terraces, diversions, and grassed waterways.

Crop residue left on or near the surface helps to conserve moisture, maintain tilth, and control erosion. Limited tillage for seedbed preparation and weed control helps to control runoff and erosion. All tillage should be on the contour or across the slope.

Fertilizer is needed to ensure the optimum growth of grasses, legumes, and crops. The fertility of this soil can be improved by returning crop residue to the soil.

The trees and shrubs grown as windbreaks and environmental plantings should be those that are tolerant of droughty conditions. A very low available water capacity may cause severe seedling mortality. Continued cultivation, mulching, or applications of herbicide to control competing vegetation are needed to ensure the establishment and survival of seedlings. Irrigation may be needed when the trees and shrubs are planted and during dry periods.

The Greenscombe soil is in the Mountain Loamy 12-16pz range site.

57D—Greenscombe loam, 12 to 35 percent north slopes. This moderately deep, well drained soil is on hills. It formed in colluvium and residuum derived from quartz diorite and related granitic rocks. Areas are irregular in shape and are 40 to 200 acres in size. The native vegetation is mainly bunchgrasses, forbs, and shrubs. Elevation is 3,200 to 3,800 feet. The average annual precipitation is 12 to 16 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 130 days.

Typically, the surface layer is very dark grayish brown and dark brown loam about 11 inches thick. The subsoil is dark yellowish brown sandy clay loam about 8 inches thick. The substratum is dark yellowish brown sandy clay loam and gravelly sandy loam. It extends to a depth of about 30 inches. The depth to weathered bedrock is 20 to 40 inches.

Included in this unit are small areas of Keating, Ridley, and Clovercreek soils. Also included are small areas of Rock outcrop, a few areas that have slopes of more than 35 percent, and a few areas of soils that are similar to the Greenscombe soil but are more than 40 inches deep over bedrock. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate in the Greenscombe soil. Available water capacity is 4 to 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 mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on this unit is dominated by Idaho fescue and squaw apple.

Idaho fescue is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 2,200 pounds per acre in favorable years and 1,000 pounds per acre in unfavorable years.

If the condition of the site deteriorates through overgrazing, Idaho fescue loses vigor and decreases in extent. Bluebunch wheatgrass and mountain big sagebrush increase in extent. Bluegrasses invade. If deterioration continues, the extent of bluebunch wheatgrass decreases, the extent of mountain big sagebrush strongly increases, and unpalatable forbs and annuals invade the site.

The Greenscombe soil is in the Mountain North 12-16pz range site.

58D—Greenscombe loam, 12 to 35 percent south slopes. This moderately deep, well drained soil is on hills. It formed in colluvium and residuum derived from quartz diorite and related granitic rocks. Areas are irregular in shape and are 40 to 200 acres in size. The native vegetation is mainly bunchgrasses, forbs, and shrubs. Elevation is 3,200 to 3,800 feet. The average annual precipitation is 12 to 16 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 130 days.

Typically, the surface layer is very dark grayish brown and dark brown loam about 11 inches thick. The subsoil is dark yellowish brown sandy clay loam about 8 inches thick. The substratum is dark yellowish brown sandy clay loam and gravelly sandy loam. It extends to a depth of about 30 inches. The depth to weathered bedrock is 20 to 40 inches.

Included in this unit are small areas of Keating and Clovercreek soils. Also included are small areas of Rock outcrop and a few areas that have slopes of more than 35 percent. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate in the Greenscombe soil. Available water capacity is 4 to 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 mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on this unit is dominated by bluebunch wheatgrass, Idaho fescue, mountain big sagebrush, and squaw apple.

Bluebunch wheatgrass is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 1,400 pounds per acre in favorable years and 700 pounds per acre in unfavorable years.

If the condition of the site deteriorates through overgrazing, bluebunch wheatgrass and Idaho fescue lose vigor and decrease in extent. Big sagebrush and Sandberg bluegrass increase in extent. If deterioration continues, annual grasses and forbs invade the site.

The Greenscombe soil is in the Mountain South 12-16pz range site.

59D—Gwinly-Immig very cobbly silt loams, 12 to 35 percent south slopes. This map unit is on hills. Areas are irregular in shape and are 40 to 200 acres in size. The native vegetation is mainly bunchgrasses, shrubs, and forbs. Elevation is 2,000 to 4,000 feet. The average annual precipitation is 14 to 20 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 120 days.

This unit is about 45 percent Gwinly very cobbly silt loam and 40 percent Immig very cobbly silt loam. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of Rockly soils. Also included are small areas of Rock outcrop. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Gwinly soil is shallow and well drained. It formed in colluvium derived from basalt and influenced by loess and volcanic ash in the surface layer. Typically, the surface layer is very dark brown very cobbly silt loam about 3 inches thick. The upper 5 inches of the subsoil is very dark brown very cobbly silty clay loam. The lower 9 inches is dark brown extremely cobbly clay. The depth to bedrock is 10 to 20 inches.

Permeability is slow in the Gwinly soil. Available water capacity is 1 to 2 inches. The effective rooting depth is 10 to 20 inches. Runoff is medium, and the hazard of water erosion is moderate or high.

The Immig soil is moderately deep and well drained. It formed in colluvium derived from basalt and influenced by loess and volcanic ash in the surface layer. Typically, the surface layer is very dark grayish brown very cobbly silt loam about 7 inches thick. The next layer is dark brown very cobbly silty clay loam about 5 inches thick. The upper part of the subsoil is dark brown very cobbly clay about 10 inches thick. The lower part is olive brown extremely cobbly clay about 4 inches thick. The depth to bedrock is 20 to 40 inches.

Permeability is moderately slow to a depth of about 7 inches in the Immig soil and slow below that depth. Available water capacity is 2 to 4 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 mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on the Gwinly soil is dominated by bluebunch wheatgrass.

Bluebunch wheatgrass is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 1,200 pounds per acre in favorable years and 400 pounds per acre in unfavorable years. Livestock access is limited by the rock fragments on the surface.

The potential plant community on the Immig soil is dominated by bluebunch wheatgrass and arrowleaf balsamroot.

Bluebunch wheatgrass is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 1,800 pounds per acre in favorable years and 1,000 pounds per acre in unfavorable years. Livestock access is limited by the rock fragments on the surface.

If the condition of the site deteriorates through overgrazing, bluebunch wheatgrass and Idaho fescue lose vigor and decrease in extent. Sandberg bluegrass increases in extent. If deterioration continues, cheatgrass, soft brome, and other annual plants invade the site.

Mechanical treatment is not practical for brush control or range seeding because of the very cobbly surface.

The Gwinly soil is in the Shallow South 14+pz range site. The Immig soil is in the South 14-17pz range site.

59E—Gwinly-Immig very cobbly silt loams, 35 to 50 percent south slopes. This map unit is on hills. Areas are irregular in shape and are 40 to 200 acres in size. The native vegetation is mainly bunchgrasses, shrubs, and forbs. Elevation is 2,000 to 4,000 feet. The average annual precipitation is 14 to 20 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 120 days.

This unit is about 50 percent Gwinly very cobbly silt loam and 40 percent Immig very cobbly silt loam. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of Rockly soils. Also included are small areas of Rock outcrop. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

The Gwinly soil is shallow and well drained. It formed in colluvium derived from basalt and influenced by loess and volcanic ash in the surface layer. Typically, the surface layer is very dark brown very cobbly silt loam about 3 inches thick. The upper 5 inches of the subsoil is very dark brown very cobbly silty clay loam. The lower 9 inches is dark brown extremely cobbly clay. The depth to bedrock is 10 to 20 inches.

Permeability is slow in the Gwinly soil. Available water capacity is 1 to 2 inches. The effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is high.

The Immig soil is moderately deep and well drained. It formed in colluvium derived from basalt and influenced by loess and volcanic ash in the surface layer. Typically, the surface layer is very dark grayish brown very cobbly silt loam about 7 inches thick. The next layer is dark brown very cobbly silty clay loam about 5 inches thick. The upper part of the subsoil is dark brown very cobbly clay about 10 inches thick. The lower part is olive brown extremely cobbly clay about 4 inches thick. The depth to bedrock is 20 to 40 inches.

Permeability is moderately slow to a depth of about 7 inches in the Immig soil and slow below that depth. Available water capacity is 2 to 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. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on the Gwinly soil is dominated by bluebunch wheatgrass, Idaho fescue, and Sandberg bluegrass.

Bluebunch wheatgrass is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 1,200 pounds per acre in favorable years and 400 pounds per acre in unfavorable years. Livestock access is limited by the slope and the rock fragments on the surface.

The potential plant community on the Immig soil is dominated by bluebunch wheatgrass and arrowleaf balsamroot.

Bluebunch wheatgrass is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 1,800 pounds per acre in favorable years and 1,000 pounds per acre in unfavorable years. Livestock access is limited by the slope and the rock fragments on the surface.

Mechanical treatment is not practical for brush control and range seeding because of the slope and the very cobbly surface.

The Gwinly soil is in the Shallow South 14+pz range site. The Immig soil is in the South 14-17pz range site.

59F—Gwinly-Immig very cobbly silt loams, 50 to 70 percent south slopes. This map unit is on hills. Areas are irregular in shape and are 40 to 200 acres in size. The native vegetation is mainly bunchgrasses, shrubs, and forbs. Elevation is 2,000 to 4,000 feet. The average annual precipitation is 14 to 20 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 120 days.

This unit is about 50 percent Gwinly very cobbly silt loam and 35 percent Immig very cobbly silt loam. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of Rock outcrop. Also included are small areas of Rockly soils. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Gwinly soil is shallow and well drained. It formed in colluvium derived from basalt and influenced by loess and volcanic ash in the surface layer. Typically, the surface layer is very dark brown very cobbly silt loam about 3 inches thick. The upper 5 inches of the subsoil is very dark brown very cobbly silty clay loam. The lower 9 inches is dark brown extremely cobbly clay. The depth to bedrock is 10 to 20 inches.

Permeability is slow in the Gwinly soil. Available water capacity is 1 to 2 inches. The effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is very high.

The Immig soil is moderately deep and well drained. It formed in colluvium derived from basalt and influenced by loess and volcanic ash in the surface layer. Typically, the surface layer is very dark grayish brown very cobbly silt loam about 7 inches thick. The next layer is dark brown very cobbly silty clay loam about 5 inches thick. The upper part of the subsoil is dark brown very cobbly clay about 10 inches thick. The lower part is olive brown extremely cobbly clay about 4 inches thick. The depth to basalt is 20 to 40 inches.

Permeability is moderately slow to a depth of about 7 inches in the Immig soil and slow below that depth. Available water capacity is 2 to 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is very high.

This unit is used mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on the Gwinly soil is dominated by bluebunch wheatgrass.

Bluebunch wheatgrass is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 1,200 pounds per acre in favorable years and 400 pounds per acre in unfavorable years. Livestock access is limited by the slope and the rock fragments on the surface.

The potential plant community on the Immig soil is dominated by bluebunch wheatgrass and arrowleaf balsamroot.

Bluebunch wheatgrass is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 1,800 pounds per acre in favorable years and 1,000 pounds per acre in unfavorable years. Livestock access is limited by the slope and the rock fragments on the surface.

If the condition of the site deteriorates through overgrazing, bluebunch wheatgrass and Idaho fescue lose vigor and decrease in extent. Sandberg bluegrass increases in extent. If deterioration continues, cheatgrass, soft brome, and other annual plants invade the site.

Mechanical treatment is not practical for brush control and range seeding because of the slope and the very cobbly surface.

The Gwinly soil is in the Shallow South 14+pz range site. The Immig soil is in the South 14-17pz range site.

60D—Gwinly-Immig-Snell very cobbly silt loams, 12 to 35 percent slopes. This map unit is on hills. Areas are irregular in shape and are 100 to 400 acres in size. The native vegetation is mainly bunchgrasses, shrubs, and forbs. Elevation is 3,400 to 4,000 feet. The average annual precipitation is 14 to 20 inches, the average annual air temperature is 42 to 50 degrees F, and the average frost-free period is 75 to 120 days.

This unit is 35 percent Gwinly very cobbly silt loam, 30 percent Immig very cobbly silt loam, and 25 percent Snell very cobbly silt loam. Typically, the Gwinly soil is in convex areas, and the Immig soil is in concave areas. Both soils generally are on south and west aspects. The Snell soil typically is on north and east aspects. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of Rockly soils on south and west aspects and Sag soils on north aspects. Also included are small areas of Rock outcrop. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

The Gwinly soil is shallow and well drained. It formed in colluvium derived from basalt and influenced by loess and volcanic ash in the surface layer. Typically, the surface layer is very dark brown very cobbly silt loam about 3 inches thick. The upper 5 inches of the subsoil is very dark brown very cobbly silty clay loam. The lower 9 inches is dark brown extremely cobbly clay. The depth to bedrock is 10 to 20 inches.

Permeability is slow in the Gwinly soil. Available water capacity is 1 to 2 inches. The effective rooting depth is 10 to 20 inches. Runoff is medium, and the hazard of water erosion is moderate or high.

The Immig soil is moderately deep and well drained. It formed in colluvium derived from basalt and influenced by loess and volcanic ash in the surface layer. Typically, the surface layer is very dark grayish brown very cobbly silt loam about 7 inches thick. The next layer is dark brown very cobbly silty clay loam about 5 inches thick. The upper part of the subsoil is dark brown very cobbly clay about 10 inches thick. The lower part is olive brown extremely cobbly clay about 4 inches thick. The depth to bedrock is 20 to 40 inches.

Permeability is moderately slow to a depth of about 7 inches in the Immig soil and slow below that depth. Available water capacity is 2 to 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate or high.

The Snell soil is moderately deep and well drained. It formed in loess and in colluvium derived from basalt. Typically, the surface layer is very dark brown very cobbly silt loam about 4 inches thick. The next layer is very dark brown very cobbly silty clay loam about 5 inches thick. The subsoil is dark brown extremely cobbly clay about 22 inches thick. The depth to bedrock is 20 to 40 inches.

Permeability is moderate to a depth of about 9 inches in the Snell soil and moderately slow below that depth. Available water capacity is 2 to 4 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 mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on the Gwinly soil is dominated by bluebunch wheatgrass.

Bluebunch wheatgrass is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 1,200 pounds per acre in favorable years and 400 pounds per acre in unfavorable years. Livestock access is limited by the rock fragments on the surface.

The potential plant community on the Immig soil is dominated by bluebunch wheatgrass and arrowleaf balsamroot.

Bluebunch wheatgrass is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 1,800 pounds per acre in favorable years and 1,000 pounds per acre in unfavorable years. Livestock grazing on this unit is limited by the rock fragments on the surface.

The potential plant community on the Snell soil in this unit is dominated by Idaho fescue and common snowberry.

Idaho fescue is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 2,200 pounds per acre in favorable years and 1,200 pounds per acre in unfavorable years. Livestock access is limited by the rock fragments on the surface.

If the condition of the site deteriorates through overgrazing, bluebunch wheatgrass and Idaho fescue lose vigor and decrease in extent. Sandberg bluegrass increases in extent. If deterioration continues, cheatgrass, soft brome, and other annual plants invade the site.

Mechanical treatment is not practical for brush control and range seeding because of the very cobbly surface.

The Gwinly soil is in the Shallow South 14+pz range site. The Immig soil is in the South 14-17pz range site. The Snell soil is in the North 14-17pz range site.

60E—Gwinly-Immig-Snell very cobbly silt loams, 35 to 50 percent slopes. This map unit is on hills. Areas are irregular in shape and are 100 to 400 acres in size. The native vegetation is mainly bunchgrasses, shrubs, and forbs. Elevation is 3,400 to 4,000 feet. The average annual precipitation is 14 to 20 inches, the average annual air temperature is 42 to 50 degrees F, and the average frost-free period is 75 to 120 days.

This unit is about 40 percent Gwinly very cobbly silt loam, 25 percent Immig very cobbly silt loam, and 25 percent Snell very cobbly silt loam. Typically, the Gwinly soil is in convex areas, and the Immig soil is in concave areas. Both soils generally are on south and west aspects. The Snell typically is on north and east aspects. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of Rockly soils on south and west aspects and Sag soils on north aspects. Also included are small areas of Rock outcrop. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

The Gwinly soil is shallow and well drained. It formed in colluvium derived from basalt and influenced by loess and volcanic ash in the surface layer. Typically, the surface layer is very dark brown very cobbly silt loam about 3 inches thick. The upper 5 inches of the subsoil is very dark brown very cobbly silty clay loam. The lower 9 inches is dark brown extremely cobbly clay. The depth to bedrock is 10 to 20 inches.

Permeability is slow in the Gwinly soil. Available water capacity is 1 to 2 inches. The effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is high.

The Immig soil is moderately deep and well drained. It formed in colluvium derived from basalt and influenced by loess and volcanic ash in the surface layer. Typically, the surface layer is very dark grayish brown very cobbly silt loam about 7 inches thick. The next layer is dark brown very cobbly silty clay loam about 5 inches thick. The upper part of the subsoil is dark brown very cobbly clay about 10 inches thick. The lower part is olive brown extremely cobbly clay about 4 inches thick. The depth to bedrock is 20 to 40 inches.

Permeability is moderately slow to a depth of about 7 inches in the Immig soil and slow below that depth. Available water capacity is 2 to 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

The Snell soil is moderately deep and well drained. It formed in loess and in colluvium derived from basalt. Typically, the surface layer is very dark brown very cobbly silt loam about 4 inches thick. The next layer is very dark brown very cobbly silty clay loam about 5 inches thick. The subsoil is dark brown extremely cobbly clay about 22 inches thick. The depth to bedrock is 20 to 40 inches.

Permeability is moderate to a depth of about 9 inches in the Snell soil and moderately slow below that depth. Available water capacity is 2 to 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. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on the Gwinly soil is dominated by bluebunch wheatgrass.

Bluebunch wheatgrass is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 1,200 pounds per acre in favorable years and 400 pounds per acre in unfavorable years. Livestock access is limited by the slope and the rock fragments on the surface.

The potential plant community on the Immig soil is dominated by bluebunch wheatgrass and arrowleaf balsamroot.

Bluebunch wheatgrass is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 1,800 pounds per acre in favorable years and 1,000 pounds per acre in unfavorable years. Livestock access is limited by the slope and the rock fragments on the surface.

The potential plant community on the Snell soil is dominated by Idaho fescue and common snowberry.

Idaho fescue is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 2,200 pounds per acre in favorable years and 1,200 pounds per acre in unfavorable years. Livestock access is limited by the slope and the rock fragments on the surface.

If the condition of the site deteriorates through overgrazing, bluebunch wheatgrass and Idaho fescue lose vigor and decrease in extent. Sandberg bluegrass increases in extent. If deterioration continues, cheatgrass, soft brome, and other annual plants invade the site.

Mechanical treatment is not practical for brush control and range seeding because of the slope and the very cobbly surface.

The Gwinly soil is in the Shallow South 14+pz range site. The Immig soil is in the South 14-17pz range site. The Snell soil is in the North 14-17pz range site.

60F—Gwinly-Immig-Snell very cobbly silt loams, 50 to 70 percent slopes. This map unit is on hills. Areas are irregular in shape and are 100 to 400 acres in size. The native vegetation is mainly bunchgrasses, shrubs, and forbs. Elevation is 3,400 to 4,000 feet. The average annual precipitation is 14 to 20 inches, the average annual air temperature is 42 to 50 degrees F, and the average frost-free period is 75 to 120 days.

This unit is about 40 percent Gwinly very cobbly silt loam, 25 percent Immig very cobbly silt loam, and 20 percent Snell very cobbly silt loam. Typically, the Gwinly soil is in convex areas, and the Immig soil is in concave areas. Both soils generally are on south and west aspects. The Snell soil typically is on north and east aspects. The components of this unit are so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of Rock outcrop and Rubble land. Also included are small areas of Rockly soils on south and west aspects and Sag soils on north aspects. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Gwinly soil is shallow and well drained. It formed in colluvium derived from basalt and influenced by loess and volcanic ash in the surface layer. Typically, the surface layer is very dark brown very cobbly silt loam about 3 inches thick. The upper 5 inches of the subsoil is very dark brown very cobbly silty clay loam. The lower 9 inches is dark brown extremely cobbly clay. The depth to bedrock is 10 to 20 inches.

Permeability is slow in the Gwinly soil. Available water capacity is 1 to 2 inches. The effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is very high.

The Immig soil is moderately deep and well drained. It formed in colluvium derived from basalt and influenced by loess and volcanic ash in the surface layer. Typically, the surface layer is very dark grayish brown very cobbly silt loam about 7 inches thick. The next layer is dark brown very cobbly silty clay loam about 5 inches thick. The upper part of the subsoil is dark brown very cobbly clay about 10 inches thick. The lower part is olive brown extremely cobbly clay about 4 inches thick. The depth to bedrock is 20 to 40 inches.

Permeability is moderately slow to a depth of about 7 inches in the Immig soil and slow below that depth. Available water capacity is 2 to 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is very high.

The Snell soil is moderately deep and well drained. It formed in loess and in colluvium derived from basalt. Typically, the surface layer is very dark brown very cobbly silt loam about 4 inches thick. The next layer is very dark brown very cobbly silty clay loam about 5 inches thick. The subsoil is dark brown extremely cobbly clay about 22 inches thick. The depth to bedrock is 20 to 40 inches.

Permeability is moderate to a depth of about 9 inches in the Snell soil and moderately slow below that depth. Available water capacity is 2 to 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is very high.

This unit is used mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on the Gwinly soil is dominated by bluebunch wheatgrass.

Bluebunch wheatgrass is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 1,200 pounds per acre in favorable years and 400 pounds per acre in unfavorable years. Livestock access is limited by the slope and the rock fragments on the surface.

The potential plant community on the Immig soil is dominated by bluebunch wheatgrass and arrowleaf balsamroot.

Bluebunch wheatgrass is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 1,800 pounds per acre in favorable years and 1,000 pounds per acre in unfavorable years. Livestock access is limited by the slope and the rock fragments on the surface.

The potential plant community on the Snell soil is dominated by Idaho fescue and common snowberry.

Idaho fescue is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 2,200 pounds per acre in favorable years and 1,200 pounds per acre in unfavorable years. Livestock access is limited by the slope and the rock fragments on the surface.

If the condition of the site deteriorates through overgrazing, bluebunch wheatgrass and Idaho fescue lose vigor and decrease in extent. Sandberg bluegrass increases in extent. If deterioration continues, cheatgrass, soft brome, and other annual plants invade the site.

Mechanical treatment is not practical for brush control and range seeding because of the slope and the very cobbly surface.

The Gwinly soil is in the Shallow South 14+pz range site. The Immig soil is in the South 14-17pz range site. The Snell soil is in the North 14-17pz range site.

61D—Gwinly-Rockly complex, 12 to 35 percent south slopes. This map unit is on hills. Areas are irregular in shape and are 40 to 200 acres in size. The native vegetation is mainly bunchgrasses and forbs. Elevation is 2,500 to 4,000 feet. The average annual precipitation is 14 to 20 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 120 days.

This unit is about 60 percent Gwinly very cobbly silt loam and 25 percent Rockly very cobbly loam. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

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

The Gwinly soil is shallow and well drained. It formed in colluvium derived from basalt and influenced by loess and volcanic ash in the surface layer. Typically, the surface layer is very dark brown very cobbly silt loam about 3 inches thick. The upper 5 inches of the subsoil is very dark brown very cobbly silty clay loam. The lower 9 inches is dark brown extremely cobbly clay. The depth to bedrock is 10 to 20 inches.

Permeability is slow in the Gwinly soil. Available water capacity is 1 to 2 inches. The effective rooting depth is 10 to 20 inches. Runoff is medium, and the hazard of water erosion is moderate or high.

The Rockly soil is very shallow and well drained. It formed in loess and in colluvium derived from basalt. Typically, the surface layer is very dark brown very cobbly loam about 2 inches thick. The subsoil is about 6 inches of dark brown extremely cobbly loam and clay loam. The depth to bedrock is 5 to 10 inches.

Permeability is moderate in the Rockly soil. Available water capacity is 0.5 to 1.0 inch. The effective rooting depth is 5 to 10 inches. Runoff is medium, and the hazard of water erosion is moderate or high.

This unit is used mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on the Gwinly soil is dominated by bluebunch wheatgrass.

Bluebunch wheatgrass is the major forage-producing plant. If the site is in excellent condition, the production is estimated at 1,200 pounds per acre in favorable years and 400 pounds per acre in unfavorable years. Livestock access is limited by the rock fragments on the surface.

The potential plant community on the Rockly soil is dominated by Sandberg bluegrass, bluebunch wheatgrass, stiff sagebrush, and lomatium.

Sandberg bluegrass and bluebunch wheatgrass are the major forage-producing plants. If the site is in excellent condition, the total annual production is estimated at 600 pounds per acre in favorable years and 200 pounds per acre in unfavorable years. Livestock access is limited by the rock fragments on the surface.

If the condition of the site deteriorates through overgrazing, bluebunch wheatgrass loses vigor and decreases in extent. Sandberg bluegrass increases in extent. If deterioration continues, cheatgrass, soft brome, and other annual plants invade the site.

Mechanical treatment is not practical for brush control and range seeding because of the very cobbly surface.

The Gwinly soil is in the Shallow South 14+pz range site. The Rockly soil is in the Very Shallow 14+pz range site.

62A—Haines silt loam, 0 to 2 percent slopes. This deep, poorly drained soil is on flood plains. It formed in mixed alluvium influenced by volcanic ash in the surface layer. Areas are irregular in shape and are 20 to 200 acres in size. The native vegetation is mainly salt-tolerant grasses and shrubs. Elevation is 2,000 to 3,400 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 110 to 140 days.

Typically, the surface layer is dark grayish brown silt loam about 3 inches thick. The next layer is dark grayish brown silt loam about 6 inches thick. The subsoil is dark grayish brown, mottled silt loam about 21 inches thick. The substratum to a depth of 60 inches or more is grayish brown silt loam and grayish brown, mottled sandy clay loam.

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

Permeability is moderately slow in the Haines soil. Available water capacity is 8 to 10 inches. The effective rooting depth is limited by a seasonal high water table at a depth of 1 to 2 feet in winter and spring. This soil is subject to rare flooding. Runoff is slow, and the hazard of water erosion is slight.

This unit is used mainly for irrigated hay and pasture. It also provides habitat for many kinds of wildlife.

Hay and pasture.—If this unit is used for hay and pasture, the main limitations are the seasonal high water table and the high amount of salts in the surface layer.

The concentration of salts and alkali in the surface layer limits the production of plants suitable for hay and pasture. Leaching of the salts from the surface layer is limited by the high water table. A drainage system and good management of irrigation water minimize the concentration of salts. Salt-tolerant species should be selected for planting.

In summer irrigation is needed or for the optimum production of hay and pasture. Controlled surface irrigation is a suitable method of applying water. Leveling helps to ensure the uniform application of water. To avoid 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.

Periodic mowing and clipping help to maintain uniform growth and prevent selective grazing. Proper grazing practices, weed control, and fertilizer are needed to ensure maximum quality of forage.

Conducting fieldwork during wet periods results in deterioration of tilth and destroys soil structure. As a result, it increases the runoff rate. Grazing during wet periods results in compaction of the surface layer. Compaction limits the movement of air in the soil and restricts the growth of roots.

Because of salt concentrations, the selection of trees and shrubs that can be grown as windbreaks and environmental plantings is limited and seedling mortality is severe. The species selected for planting should be those that can withstand excess moisture. Spring planting may be delayed because of the excess moisture.

The Haines soil is in the Sodic Meadow range site.

63A—Halfway clay, 0 to 3 percent slopes. This deep, moderately well drained soil is on alluvial fans and flood plains. It formed in fine-textured mixed alluvium. Areas are irregular in shape and are 20 to 100 acres in size. The native vegetation is mainly bunchgrasses and forbs. Elevation is 2,700 to 3,400 feet. The average annual precipitation is 18 to 22 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 110 to 130 days.

Typically, the surface layer is black clay about 22 inches thick. The next layer is very dark brown clay about 8 inches thick. The substratum to a depth of 60 inches or more is dark brown and dark yellowish brown clay loam.

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

Permeability is very slow in the Halfway soil. Available water capacity is 7 to 9 inches. The effective rooting depth is limited by a seasonal high water table at a depth of 3 to 5 feet in spring and early summer. Runoff is slow, and the hazard of water erosion is slight.

This unit is used mainly for irrigated hay and pasture or small grain. It also is used for homesite development, and it provides habitat for many kinds of wildlife.

Hay and pasture or cropland.—If this unit is used as hayland, pasture, or cropland, the main limitations are the very slow permeability and a high content of clay in the surface layer.

These soils generally are not suitable for deep-rooted perennial crops because adequate drainage usually cannot be maintained in winter and spring. Drainage of this soil is difficult and expensive because the dense clay requires close spacing of the tile drains.

Management that maintains the optimum vigor and quality of forage plants is needed. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and control erosion. Periodic mowing and clipping help to maintain uniform growth and prevent selective grazing.

Fertilizer is needed to ensure the optimum growth of grasses, legumes, or crops. Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain soil fertility and tilth.

In summer irrigation is needed for the maximum production of most crops. The method used generally is governed by the crop grown. Furrow, border, corrugation, and sprinkler irrigation systems are suited to this soil. Leveling helps to ensure the uniform application of water. To avoid 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.

Conducting fieldwork during wet periods results in deterioration of tilth and destroys soil structure. As a result, it increases the runoff rate and the hazard of erosion. Runoff and erosion can be controlled by managing residue and using rough or minimum tillage.

Grazing during wet periods results in compaction of the surface layer, poor tilth, and excessive runoff. Compaction limits the movement of air and water in the soil and restricts the growth of roots.

A wide variety of trees and shrubs can be grown as windbreaks and environmental plantings on this soil. Seedling mortality is severe.

Homesite development.—If this unit is used for homesite development, the main limitations are the very slow permeability and a high shrink-swell potential.

On sites for septic tank absorption fields, the very slow permeability can be overcome by increasing the size of the absorption fields. Properly designing the footings and foundations of buildings helps to prevent the structural damage caused by shrinking and swelling. A drainage system is needed if roads and building foundations are constructed. Wetness can be reduced by installing subsurface drains around footings.

The Halfway soil is in the Meadow range site.

64C—Hall Ranch stony loam, 2 to 12 percent slopes. This moderately deep, well drained soil is on mountains. It formed in mixed volcanic ash, loess, and colluvium derived dominantly from andesite and basalt. Areas are irregular in shape and are 80 to 200 acres in size. The native vegetation is mainly conifers, shrubs, and forbs. Elevation is 4,400 to 5,400 feet. The average annual precipitation is 20 to 30 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 50 to 90 days.

Typically, the surface layer is very dark brown stony loam about 6 inches thick. The upper 20 inches of the subsoil is very dark grayish brown and dark brown gravelly loam. The lower 11 inches is dark brown gravelly clay loam. The depth to bedrock is 20 to 40 inches.

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

Permeability is moderately slow in the Hall Ranch soil. Available water capacity is 4 to 6 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 mainly for timber production. It also is used for livestock grazing, and it provides habitat for many kinds of wildlife.

Woodland.—This unit is suited to the production of ponderosa pine and Douglas-fir. The mean site index is 87 for ponderosa pine (100-year base age) and 68 for Douglas-fir (50-year base age). The potential production at culmination of the mean annual increment for ponderosa pine is 80 cubic feet per acre per year (5.6 cubic meters per hectare per year) in a 40-year-old, even-aged, fully stocked stand and for Douglas-fir is 58 cubic feet per acre per year (4.1 cubic meters per hectare per year) in a 104-year-old, even-aged, fully stocked stand.

The main concerns in producing and harvesting timber are the hazard of erosion, the equipment limitation, seedling mortality, the hazard of windthrow, plant competition, and fire damage to the soil.

Minimizing the risk of erosion is essential in areas where timber is harvested. Properly designed road drainage systems that include carefully located culverts help to control erosion. Roads, landings, skid trails, and firebreaks can be protected against erosion by constructing water bars and by seeding areas that have been cut and filled. Buffer strips may be needed in areas adjacent to perennial streams to minimize siltation and maintain stream temperatures.

Use of conventional wheeled and tracked equipment is generally suitable, but the soil may be compacted if it is wet when heavy equipment is used. The risk of compaction can be reduced by using low-pressure ground equipment, laying out skid trails in advance, and harvesting timber when the soil is dry or frozen.

Careful management of reforestation is needed to minimize competition from undesirable plants. If the site is not adequately prepared, plant competition can prevent or delay reestablishment of volunteer or planted trees. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying.

The seedling mortality rate is increased by compaction of the surface layer because compaction limits the movement of water and air in the soil and restricts the growth of roots. The trees that are suitable for planting include ponderosa pine and Douglas-fir.

Trees are subject to windthrow because of the restricted rooting depth. They are particularly susceptible during periods when the soil is excessively wet and winds are strong. Regeneration systems that isolate single trees or groups of trees are not practical because of the hazard of windthrow.

Some decline in forest productivity may result from fire of moderate intensity.

Grazable woodland.—This unit is suitable for use as grazable woodland. The understory consists mainly of princes pine, low Oregongrape, myrtle pachystima, elk sedge, pinegrass, and heartleaf arnica.

A system that results in proper grazing use is essential if livestock graze this unit. Timely deferment of grazing is needed to allow the desirable plants to mature and set seed. Grazing should be delayed in spring until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.

Seeding disturbed areas to suitable plants reduces the hazard of erosion and provides forage for livestock and wildlife. Deferred grazing is needed during periods when seedlings are becoming established.

This soil can produce adequate forage for big game animals after the tree canopy is opened by logging, fire, or some other disturbance. Stands of timber should be left in some areas to provide escape and thermal cover for the big game animals.

The Hall Ranch soil is in the Fir-Pine-Sedge woodland understory site.

65D—Hankins silt loam, 12 to 35 percent north slopes. This deep, well drained soil is on mountains. It formed in colluvium mixed with volcanic ash in the upper part over old tuffaceous sediments. Areas are irregular in shape and are 40 to 200 acres in size. The native vegetation is mainly conifers, shrubs, and grasses. Elevation is 4,000 to 5,000 feet. The average annual precipitation is 16 to 30 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 30 to 50 days.

Typically, the surface layer is very dark gray silt loam about 4 inches thick. The next layer is very dark grayish brown silt loam about 5 inches thick. The subsoil is about 38 inches of dark brown gravelly clay and silty clay. The depth to weathered sediments is 40 to 60 inches.

Included in this unit are small areas of Hankins very cobbly loam. Also included are small areas of Boiler and Derringer soils. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is slow in the Hankins soil. Available water capacity is 5 to 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. It also is used for livestock grazing, and it provides habitat for many kinds of wildlife.

Woodland.—This unit is suited to the production of ponderosa pine. The mean site index is 75 for ponderosa pine (100-year base age). The potential production at culmination of the mean annual increment for ponderosa pine is 62 cubic feet per acre per year (4.3 cubic meters per hectare per year) in a 50-year-old, even-aged, fully stocked stand.

The main concerns in producing and harvesting timber are the hazard of erosion, the equipment limitation, seedling mortality, the hazard of windthrow, and plant competition.

Minimizing the risk of erosion is essential in areas where timber is harvested. Properly designed road drainage systems that include carefully located culverts help to control erosion. Spoil from excavations is subject to rill and gully erosion and to sloughing. Roads, landings, skid trails, and firebreaks can be protected against erosion by constructing water bars and by seeding areas that have been cut and filled. Buffer strips may be needed in areas adjacent to perennial streams to minimize siltation and maintain stream temperatures.

Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. The risk of compaction can be reduced by using low-pressure ground equipment, laying out skid trails in advance, and harvesting timber when the soil is dry or frozen. Cable yarding systems that partially or fully suspend logs generally do less damage to the soil than conventional ground-based systems.

Careful management of reforestation is needed to minimize competition from undesirable plants. If the site is not adequately prepared, plant competition can prevent or delay reestablishment of volunteer or planted trees. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying.

The seedling mortality rate is increased by compaction of the surface layer because compaction limits the movement of water and air in the soil and restricts the growth of roots. The trees that are suitable for planting include ponderosa pine.

Trees are subject to windthrow because of the restricted rooting depth. They are particularly susceptible during periods when the soil is excessively wet and winds are strong. Regeneration systems that isolate single trees or groups of trees are not practical because of the hazard of windthrow.

Grazable woodland.—This unit is suitable for use as grazable woodland. The understory consists mainly of common snowberry, spirea, elk sedge, pinegrass, Idaho fescue, and strawberry. The potential production of the native understory plants in a normal year is about 800 pounds of air-dry forage per acre.

A system that results in proper grazing use is essential if livestock graze this unit. Timely deferment of grazing is needed to allow the desirable plants to mature and set seed. Grazing should be delayed in spring until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.

Seeding disturbed areas to suitable plants reduces the hazard of erosion and provides forage for livestock and wildlife. Deferred grazing is needed during periods when seedlings are becoming established.

This soil can produce adequate forage for big game animals after the tree canopy is opened by logging, fire, or some other disturbance. Stands of timber should be left in some areas to provide escape and thermal cover for the big game animals.

The Hankins soil is in the Pine-Snowberry-Sedge woodland understory site.

66D—Hankins very cobbly loam, 12 to 35 percent north slopes. This deep, well drained soil is on mountains. It formed in colluvium mixed with volcanic ash in the upper part over old tuffaceous sediments. Areas are irregular in shape and are 40 to 100 acres in size. The native vegetation is mainly conifers, shrubs, and grasses. Elevation is 4,000 to 5,000 feet. The average annual precipitation is 16 to 30 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 30 to 50 days.

Typically, the surface layer is dark brown very cobbly loam about 9 inches thick. The upper 8 inches of the subsoil is dark brown gravelly clay loam. The lower 43 inches is dark brown and dark yellowish brown gravelly clay and silty clay. The depth to weathered sediments is more than 60 inches.

Included in this unit are small areas of Hankins silt loam. Also included are small areas of Hudspeth and Derringer soils. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is slow in the Hankins soil. Available water capacity is 7 to 10 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 mainly for timber production. It also is used for livestock grazing, and it provides habitat for many kinds of wildlife.

Woodland.—This unit is suited to the production of ponderosa pine. The mean site index is 75 for ponderosa pine (100-year base age). The potential production at culmination of the mean annual increment for ponderosa pine is 62 cubic feet per acre per year (4.3 cubic meters per hectare per year) in a 50-year-old, even-aged, fully stocked stand.

The main concerns in producing and harvesting timber are the hazard of erosion, the equipment limitation, seedling mortality, plant competition, and fire damage to the soil.

Minimizing the risk of erosion is essential in areas where timber is harvested. Properly designed road drainage systems that include carefully located culverts help to control erosion. Spoil from excavations is subject to rill and gully erosion and to sloughing. Roads, landings, skid trails, and firebreaks can be protected against erosion by constructing water bars and by seeding areas that have been cut and filled. Buffer strips may be needed in areas adjacent to perennial streams to minimize siltation and maintain stream temperatures.

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. The risk of compaction can be reduced by using low-pressure ground equipment, laying out skid trails in advance, and harvesting timber when the soil is dry or frozen. Cable yarding systems that partially or fully suspend logs generally do less damage to the soil than conventional ground-based systems.

Careful management of reforestation is needed to minimize competition from undesirable plants. If the site is not adequately prepared, plant competition can prevent or delay reestablishment of volunteer or planted trees. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying.

The seedling mortality rate is increased by compaction of the surface layer because compaction limits the movement of water and air in the soil and restricts the growth of roots. The trees that are suitable for planting include ponderosa pine.

Some decline in forest productivity may result from fire of moderate intensity.

Grazable woodland.—This unit is suitable for use as grazable woodland. The understory consists mainly of common snowberry, spirea, elk sedge, pinegrass, Idaho fescue, and strawberry. The potential production of the native understory plants in a normal year is about 800 pounds of air-dry forage per acre.

A system that results in proper grazing use is essential if livestock graze this unit. Timely deferment of grazing is needed to allow the desirable plants to mature and set seed. Grazing should be delayed in spring until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.

Seeding disturbed areas to suitable plants reduces the hazard of erosion and provides forage for livestock and wildlife. Deferred grazing is needed during periods when seedlings are becoming established.

This soil can produce adequate forage for big game animals after the tree canopy is opened by logging, fire, or some other disturbance. Stands of timber should be left in some areas to provide escape and thermal cover for the big game animals.

The Hankins soil is in the Pine-Snowberry-Sedge woodland understory site.

67C—Hankins complex, 2 to 12 percent slopes. This map unit is on mountains. Areas are irregular in shape and are 40 to 100 acres in size. The native vegetation is mainly conifers, shrubs, and grasses. Elevation is 4,000 to 5,000 feet. The average annual precipitation is 16 to 30 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 30 to 50 days.

This unit is about 45 percent Hankins silt loam and 40 percent Hankins very cobbly loam. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

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

Hankins silt loam is deep and well drained. It formed in colluvium mixed with volcanic ash in the upper part over old tuffaceous sediments. Typically, the surface layer is very dark gray silt loam about 4 inches thick. The next layer is very dark grayish brown silt loam about 5 inches thick. The subsoil is about 38 inches of dark brown gravelly clay and silty clay. The depth to weathered sediments is 40 to 60 inches.

Permeability is slow in Hankins silt loam. Available water capacity is 5 to 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.

Hankins very cobbly loam is deep and well drained. It formed in colluvium mixed with volcanic ash in the upper part over old tuffaceous sediments. Typically, the surface layer is dark brown very cobbly loam about 9 inches thick. The upper 8 inches of the subsoil is dark brown gravelly clay loam. The lower 43 inches is dark brown and dark yellowish brown gravelly clay and silty clay. The depth to weathered sediments is 60 inches or more.

Permeability is slow in Hankins very cobbly loam. Available water capacity is 7 to 10 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. It also is used for livestock grazing, and it provides habitat for many kinds of wildlife.

Woodland.—This unit is suited to the production of ponderosa pine. The mean site index is 75 for ponderosa pine (100-year base age). The potential production at culmination of the mean annual increment for ponderosa pine is 62 cubic feet per acre per year (4.3 cubic meters per hectare per year) in a 50-year-old, even-aged, fully stock stand.

The main concerns in producing and harvesting timber are the hazard of erosion, the equipment limitation, seedling mortality, plant competition, and the hazard of windthrow.

Minimizing the risk of erosion is essential in areas where timber is harvested. Properly designed road drainage systems that include carefully located culverts help to control erosion. Spoil from excavations is subject to rill and gully erosion and to sloughing. Roads, landings, skid trails, and firebreaks can be protected against erosion by constructing water bars and by seeding areas that have been cut and filled. Buffer strips may be needed in areas adjacent to perennial streams to minimize siltation and maintain stream temperatures.

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. The risk of compaction can be reduced by using low-pressure ground equipment, laying out skid trails in advance, and harvesting timber when the soil is dry or frozen. Compaction limits the movement of water and air in the soil and restricts the growth of roots. Cable yarding systems that partially or fully suspend logs generally do less damage to the soil than conventional ground-based systems.

Careful management of reforestation is needed to minimize competition from undesirable plants. If the site is not adequately prepared, plant competition can prevent or delay reestablishment of volunteer or planted trees. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying.

The seedling mortality rate is increased by compaction of the surface layer. Shading and mulching of seedlings may be required. The trees that are suitable for planting include ponderosa pine.

Trees are subject to windthrow because of the restricted rooting depth. They are particularly susceptible during periods when the soil is excessively wet and winds are strong. Regeneration systems that isolate single trees or groups of trees are not practical because of the hazard of windthrow.

Grazable woodland.—This unit is suitable for use as grazable woodland. The understory consists mainly of common snowberry, spirea, elk sedge, pinegrass, Idaho fescue, and strawberry. The potential production of the native understory plants in a normal year is about 800 pounds of air-dry forage per acre.

A system that results in proper grazing use is essential if livestock graze this unit. Timely deferment of grazing is needed to allow the desirable plants to mature and set seed. Grazing should be delayed in spring until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.

Seeding disturbed areas to suitable plants increases forage production. Deferred grazing is needed during periods when seedlings are becoming established.

These soils can produce adequate forage for big game animals after the tree canopy is opened by logging, fire, or some other disturbance. Stands of timber should be left in some areas to provide escape and thermal cover for the big game animals.

The Hankins soils are in the Pine-Snowberry-Sedge woodland understory site.

68C—Harlow extremely stony clay loam, 3 to 12 percent slopes. This shallow, well drained soil is on mountains. It formed in colluvium derived from argillite, rhyolitic tuff, and breccia. Areas are irregular in shape and are 40 to 200 acres in size. The native vegetation is mainly bunchgrasses, shrubs, and forbs. Elevation is 4,000 to 5,700 feet. The average annual precipitation is 16 to 20 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 50 to 90 days.

Typically, the surface layer is very dark grayish brown extremely stony clay loam about 4 inches thick. The next layer is dark brown extremely gravelly clay loam about 8 inches thick. The subsoil is dark brown extremely cobbly clay about 6 inches thick. The depth to bedrock is 10 to 20 inches.

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

Permeability is slow in the Harlow soil. Available water capacity is 1 to 2 inches. The effective rooting depth is 10 to 20 inches. Runoff is slow, and the hazard of water erosion is slight or moderate.

This unit is used mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on this unit is dominated by stiff sagebrush, Sandberg bluegrass, and Idaho fescue.

Sandberg bluegrass and Idaho fescue are the major forage-producing plants. If the site is in excellent condition, the total annual production is estimated at 800 pounds per acre in favorable years and 400 pounds per acre in unfavorable years. Livestock access is limited by the rock fragments on the surface.

If the condition of the site deteriorates through overgrazing, Idaho fescue loses vigor and decreases in extent. Sandberg bluegrass and stiff sagebrush increase in extent. If deterioration continues, the extent of Sandberg bluegrasss decreases.

Mechanical treatment for range seeding is not practical because of the extremely stony surface layer. Brush control is not recommended because of the value of the stiff sagebrush in this unit for wildlife.

The Harlow soil is in the Mountain Very Shallow 16-20pz range site.

69E—Harlow-Derringer complex, 35 to 60 percent south slopes. This map unit is on mountains. Areas are irregular in shape and are 80 to 200 acres in size. The native vegetation is mainly bunchgrasses, shrubs, and forbs. Elevation is 4,000 to 5,700 feet. The average annual precipitation is 16 to 20 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 50 to 90 days.

This unit is about 50 percent Harlow extremely stony clay loam and 35 percent Derringer very gravelly loam. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of Rock outcrop. Also included are small areas of Hudspeth soils. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Harlow soil is shallow and well drained. It formed in colluvium derived from argillite. Typically, the surface layer is very dark grayish brown extremely stony clay loam about 4 inches thick. The next layer is dark brown extremely gravelly clay loam about 8 inches thick. The subsoil is dark brown extremely cobbly clay about 6 inches thick. The depth to bedrock is 10 to 20 inches.

Permeability is slow in the Harlow soil. Available water capacity is 1 to 2 inches. The effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is high or very high.

The Derringer soil is moderately deep and well drained. It formed in colluvium derived from rhyolitic tuff. Typically, the surface layer is very dark grayish brown very gravelly loam about 6 inches thick. The next layer is dark brown very gravelly clay loam about 11 inches thick. The upper 9 inches of the subsoil is dark brown extremely gravelly clay loam. The lower 10 inches is dark brown extremely gravelly silty clay. The depth to weathered bedrock is 20 to 40 inches.

Permeability is slow in the Derringer soil. Available water capacity is 2 to 5 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high or very high.

This unit is used mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on the Harlow soil is dominated by bluebunch wheatgrass, mountain big sagebrush, squaw apple, and antelope bitterbrush.

Bluebunch wheatgrass is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 1,100 pounds per acre in favorable years and 500 pounds per acre in unfavorable years. Livestock access is limited by the slope and the rock fragments on the surface.

The potential plant community on the Derringer soil is dominated by bluebunch wheatgrass, mountain big sagebrush, squaw apple, bitter cherry, and antelope bitterbrush.

Bluebunch wheatgrass is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 1,800 pounds per acre in favorable years and 1,000 pounds per acre in unfavorable years. Livestock access is limited by the slope and the rock fragments on the surface.

If the condition of the site deteriorates through overgrazing, bluebunch wheatgrass loses vigor and decreases in extent. Bitter cherry and antelope bitterbrush become decadent. Sandberg bluegrass, mountain big sagebrush, and perennial forbs increase in extent. If deterioration continues, cheatgrass, soft brome, and other annual plants invade the site.

Brush control is generally not advisable because of the value of palatable shrubs on this unit for wildlife.

The Harlow soil is in the Mountain Shallow South 16-20pz range site. The Derringer soil is in the Shrubby Mountain South 16-20pz range site.

70A—Hershal silt loam, 0 to 2 percent slopes. This deep, poorly drained soil is on flood plains. It formed in mixed alluvium. Areas are elongated and are 20 to 100 acres in size. The native vegetation is mainly sedges, rushes, bunchgrasses, and willows. Elevation is 2,300 to 3,400 feet. The average annual precipitation is 18 to 22 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 110 to 130 days.

Typically, the surface layer is very dark brown silt loam about 8 inches thick. The next layer is black silt loam about 8 inches thick. The upper 8 inches of the substratum is very dark grayish brown very fine sandy loam. The lower part to a depth of 60 inches or more is multicolored very gravelly sand. Depth to the very gravelly sand is 20 to 40 inches.

Included in this unit are small areas of Catherine, Langrell, and La Grande soils. Also included are small areas of soils that are similar to the Hershal soil but have a very gravelly surface layer. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate to a depth of about 24 inches in the Hershal soil and very rapid below that depth. Available water capacity is 5 to 7 inches. The effective rooting depth is limited by a seasonal high water table at a depth of 0.5 foot to 1.5 feet in spring and early summer. This soil is subject to rare flooding. Runoff is slow, and the hazard of erosion is slight.

This unit is used mainly for irrigated hay and pasture. It also provides habitat for many kinds of wildlife.

Hay and pasture.—If this unit is used for hay and pasture, the main limitation is the seasonal high water table. Wetness limits the choice of plants and the period of cutting or grazing.

Grazing during wet periods results in compaction of the surface layer, poor tilth, and excessive runoff. Conducting fieldwork during wet periods results in deterioration of tilth and destroys soil structure. As a result, it increases the runoff rate and the hazard of erosion. Compaction limits the movement of air and water in the soil and restricts the growth of roots.

Fertilizer is needed to ensure the optimum growth of grasses and legumes. Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain soil fertility and tilth.

In summer irrigation is needed for the maximum production of hay. Controlled flooding is a suitable method of applying water. To avoid 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.

Management that maintains the optimum vigor and quality of forage plants is needed. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and control erosion. Periodic mowing and clipping help to maintain uniform growth and prevent selective grazing.

The Hershal soil is in the Meadow range site.

71B—Hibbard silt loam, 2 to 7 percent slopes. This well drained soil is on terraces. It is moderately deep to a duripan. It formed in mixed alluvium. Areas are irregular in shape and are 40 to 200 acres in size. The native vegetation is mainly bunchgrasses, forbs, and shrubs. Elevation is 3,000 to 3,700 feet. The average annual precipitation is 12 to 16 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 110 to 130 days.

Typically, the surface layer is very dark gray silt loam about 9 inches thick. The upper 19 inches of the subsoil is very dark grayish brown clay. The lower 6 inches is yellowish brown silty clay loam. Below this is a brownish yellow, massive duripan about 26 inches thick. The depth to a duripan is 20 to 40 inches.

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

Permeability is slow above the duripan in the Hibbard soil. Available water capacity is 3 to 7 inches. The effective rooting depth is 20 to 40 inches. Runoff is slow, and the hazard of water erosion is slight or moderate.

This unit is used mainly for irrigated hay and pasture or small grain. It also is used for homesite development, and it provides habitat for many kinds of wildlife.

Hay and pasture or cropland.—This unit is suited to hay and pasture and to small grain. It has few limitations.

Management that maintains the optimum vigor and quality of forage plants is needed. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and control erosion. Periodic mowing and clipping help to maintain uniform growth and prevent selective grazing.

In summer irrigation is needed for the maximum production of most crops. Irrigation water can be applied by the controlled surface or sprinkler methods. Sprinkler irrigation permits the even, controlled application of water, helps to control runoff, and minimizes the risk of erosion. To avoid 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.

Fertilizer is needed to ensure the optimum growth of grasses and legumes. Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain soil fertility and tilth.

Conducting fieldwork during wet periods results in deterioration of tilth and destroys soil structure. As a result, it increases the runoff rate and the hazard of erosion. Runoff and erosion can be controlled by maintaining residue and using rough or minimum tillage. All tillage should be on the contour or across the slope.

Grazing during wet periods results in compaction of the surface layer, poor tilth, and excessive erosion. Compaction limits the movement of air and water in the soil and restricts the growth of roots.

A wide variety of trees and shrubs can be grown as windbreaks and environmental plantings on this soil. Seedling mortality is severe because the high content of clay causes moisture stress in the seedlings. Cultivation or applications of herbicide help to remove competing vegetation.

Homesite development.—If this unit is used for homesite development, the main limitations are a moderate depth to a cemented duripan, a high shrink-swell potential, low strength, and the slow permeability in the clayey subsoil.

Septic tank absorption fields may function poorly because of the limited depth to a duripan and the restricted permeability. These limitations can be overcome by increasing the size of the absorption fields. Properly designing the foundations and footings of buildings and diverting runoff away from the buildings help to prevent the structural damage caused by shrinking and swelling and by frost action.

The Hibbard soil is in the Mountain Clayey 12-16pz range site.

71C—Hibbard silt loam, 7 to 12 percent slopes. This well drained soil is on terraces. It is moderately deep to a duripan. It formed in mixed alluvium. Areas are irregular in shape and are 40 to 200 acres in size. The native vegetation is mainly bunchgrasses, forbs, and shrubs. Elevation is 3,000 to 3,700 feet. The average annual precipitation is 12 to 16 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 110 to 130 days.

Typically, the surface layer is very dark gray silt loam about 9 inches thick. The upper 19 inches of the subsoil is very dark grayish brown clay. The lower 6 inches is yellowish brown silty clay loam. Below this is a brownish yellow, massive duripan about 26 inches thick. The depth to a duripan is 20 to 40 inches.

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

Permeability is slow above the duripan in the Hibbard soil. Available water capacity is 3 to 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 mainly for hay and pasture. In a few areas it is used for small grain. It also provides habitat for many kinds of wildlife.

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

Management that maintains the optimum vigor and quality of forage plants is needed. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and control erosion. Periodic mowing and clipping help to maintain uniform growth and prevent selective grazing.

In summer irrigation is needed for the maximum production of most crops. Irrigation water can be applied by the sprinkler method. Sprinkler irrigation permits the even, controlled application of water, helps to control runoff, and minimizes the risk of erosion. To avoid 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.

Fertilizer is needed to ensure the optimum growth of grasses and legumes. Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain soil fertility and tilth.

Conducting fieldwork during wet periods results in deterioration of tilth and destroys soil structure. As a result, it increases the runoff rate and the hazard of erosion. Runoff and erosion can be controlled by maintaining residue and using rough or minimum tillage. All tillage should be on the contour or across the slope.

Grazing during wet periods results in compaction of the surface layer, poor tilth, and excessive erosion. Compaction limits the movement of air and water in the soil and restricts the growth of roots.

A wide variety of trees and shrubs can be grown as windbreaks and environmental plantings on this soil. Seedling mortality is severe because the high content of clay causes moisture stress in the seedlings. Cultivation or applications of herbicide help to remove competing vegetation.

The Hibbard soil is in the Mountain Clayey 12-16pz range site.

72C—Hibbard gravelly silty clay loam, 2 to 12 percent slopes. This well drained soil is on terraces. It is moderately deep to a duripan. It formed in mixed alluvium. Areas are irregular in shape and are 40 to 200 acres in size. The native vegetation is mainly bunchgrasses, forbs, and shrubs. Elevation is 3,000 to 3,700 feet. The average annual precipitation is 12 to 16 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 110 to 130 days.

Typically, the surface layer is very dark gray gravelly silty clay loam about 9 inches thick. The upper 19 inches of the subsoil is very dark grayish brown clay. The lower 6 inches is yellowish brown silty clay loam. Below this is a brownish yellow, massive duripan about 26 inches thick. The depth to a duripan is 20 to 40 inches.

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

Permeability is slow above the duripan in the Hibbard soil. Available water capacity is 3 to 7 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 mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on this unit is dominated by Idaho fescue and mountain big sagebrush.

Idaho fescue is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 2,000 pounds per acre in favorable years and 1,000 pounds per acre in unfavorable years.

If the condition of the site deteriorates through overgrazing, Idaho fescue loses vigor and decreases in extent. Mountain big sagebrush, basin big sagebrush, bluebunch wheatgrass, and Sandberg bluegrass increase in extent. If deterioration continues, the extent of bluebunch wheatgrass decreases, the extent of big sagebrush strongly increases, and annuals invade the site.

The Hibbard soil is in the Mountain Clayey 12-16pz range site.

73B—Hibbard-Rockly complex, 2 to 7 percent slopes. This map unit is on terraces. Areas are irregular in shape and are 20 to 200 acres in size. The native vegetation is mainly bunchgrasses, forbs, and shrubs. Elevation is 3,300 to 3,700 feet. The average annual precipitation is 12 to 16 inches, the average annual air temperature is 45 to 50 degrees F, and the frost-free period is 110 to 130 days.

This unit is about 50 percent Hibbard gravelly silty clay loam and about 40 percent Rockly very cobbly loam. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of soils that are similar to the Rockly soil but are more than 12 inches deep to a duripan. Also included are small areas of soils that are similar to the Hibbard soil but have cobbles on the surface. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

The Hibbard soil is moderately deep to a duripan and is well drained. It formed in mixed alluvium. Typically, the surface layer is very dark gray gravelly silty clay loam about 9 inches thick. The upper 19 inches of the subsoil is very dark grayish brown clay. The lower 6 inches is yellowish brown silty clay loam. Below this is a brownish yellow, massive duripan about 26 inches thick. The depth to a duripan is 20 to 40 inches.

Permeability is slow above the duripan in the Hibbard soil. Available water capacity is 3 to 7 inches. The effective rooting depth is 20 to 40 inches. Runoff is slow, and the hazard of water erosion is slight or moderate.

The Rockly soil is very shallow to a duripan and well drained. It formed in mixed alluvium. Typically, the surface layer is very dark brown very cobbly loam about 3 inches thick. The subsoil is dark brown very cobbly loam. It extends to a depth of about 9 inches. The depth to a duripan is 6 to 12 inches.

Permeability is moderate in the Rockly soil. Available water capacity is 0.5 to 1.0 inch. The effective rooting depth is 6 to 12 inches. Runoff is slow, and the hazard of water erosion is slight or moderate.

This unit is used mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on the Hibbard soil is dominated by Idaho fescue and mountain big sagebrush.

Idaho fescue is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 2,000 pounds per acre in favorable years and 1,000 pounds per acre in unfavorable years.

The potential plant community on the Rockly soil is dominated by Sandberg bluegrass, stiff sagebrush, and buckwheat.

Sandberg bluegrass is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 550 pounds per acre in favorable years and 250 pounds per acre in unfavorable years. Livestock access is limited by the rock fragments on the surface.

If the condition of the site deteriorates through overgrazing, Idaho fescue loses vigor and decreases in extent. Bluebunch wheatgrass, Sandberg bluegrass, mountain big sagebrush, and basin big sagebrush increase in extent. If deterioration continues, the extent of bluebunch wheatgrass decreases, the extent of big sagebrush strongly increases, and unpalatable perennial forbs and annuals invade the site.

Mechanical treatment for brush control and range seeding is not practical because of shallow soil depth and the very cobbly surface of the Rockly soil.

The Hibbard soil is in the Mountain Clayey 12-16pz range site. The Rockly soil is in the Mountain Very Shallow 12-16pz range site.

74D—Highhorn-Huntrock very gravelly silt loams, 12 to 30 percent south slopes. This map unit is on mountains. Areas are irregular in shape and are 100 to 400 acres in size. The native vegetation is mainly conifers, shrubs, and grasses. Elevation is 3,800 to 7,200 feet. The average annual precipitation is 20 to 30 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 45 to 90 days.

This unit is about 60 percent Highhorn very gravelly silt loam and 25 percent Huntrock very gravelly silt loam. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of McEwen soils. Also included are small areas of Crackler and Rouen soils on north aspects. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Highhorn soil is deep and well drained. It formed in colluvium derived from argillite and influenced by volcanic ash in the surface layer. Typically, the surface layer is black and very dark brown very gravelly silt loam about 9 inches thick. The upper 23 inches of the subsoil is brown very gravelly silty clay loam. The lower 11 inches is yellowish brown extremely gravelly silty clay loam. The depth to bedrock is 40 to 60 inches.

Permeability is moderate to a depth of about 9 inches in the Highhorn soil and moderately slow below that depth. Available water capacity is 3 to 7 inches. The effective rooting depth is 40 to 60 inches. Runoff is medium, and the hazard of water erosion is moderate or high.

The Huntrock soil is moderately deep and well drained. It formed in colluvium derived from argillite and influenced by volcanic ash in the surface layer. Typically, the surface layer is very dark brown very gravelly silt loam about 12 inches thick. The upper 13 inches of the subsoil is dark brown extremely gravelly clay loam. The lower 10 inches is yellowish brown extremely cobbly clay loam. The depth to bedrock is 20 to 40 inches.

Permeability is moderate to a depth of about 12 inches in the Huntrock soil and moderately slow below that depth. Available water capacity is 2 to 5 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 mainly for timber production and livestock grazing. It also provides habitat for many kinds of wildlife.

Woodland.—The Highhorn soil is suited to the production of ponderosa pine and Douglas-fir. The mean site index is 77 for ponderosa pine (100-year base age) and 63 for Douglas-fir (50-year base age). The potential production at culmination of the mean annual increment for ponderosa pine is 64 cubic feet per acre per year (4.5 cubic meters per hectare per year) in a 50-year-old, even-aged, fully stocked stand and for Douglas-fir is 49 cubic feet per acre per year (3.4 cubic meters per hectare per year) in a 108-year-old, even-aged, fully stocked stand.

The Huntrock soil is suited to the production of ponderosa pine and Douglas-fir. The mean site index is 61 for ponderosa pine (100-year base age) and 62 for Douglas-fir (50-year base age). The potential production at culmination of the mean annual increment for ponderosa pine is 47 cubic feet per acre per year (3.3 cubic meters per hectare per year) in a 50-year-old, even-aged, fully stocked stand and for Douglas-fir is 47 cubic feet per acre per year (3.3 cubic meters per hectare per year) in a 109-year-old, even-aged, fully stocked stand.

The main concerns in producing and harvesting timber are the hazard of erosion, the equipment limitation, seedling mortality, the hazard of windthrow, plant competition, and fire damage to the soil.

Minimizing the risk of erosion is essential in areas where timber is harvested. Properly designed road drainage systems that include carefully located culverts help to control erosion. Spoil from excavations is subject to rill and gully erosion and to sloughing. Roads, landings, skid trails, and firebreaks can be protected against erosion by constructing water bars and by seeding areas that have been cut and filled.

Use of standard wheeled and tracked equipment is generally suitable. Maintaining the understory is essential in controlling erosion. Cable yarding systems generally do less damage to the soil than conventional ground-based systems.

Careful management of reforestation is needed to minimize competition from undesirable plants. If the site is not adequately prepared, plant competition can prevent or delay reestablishment of volunteer or planted trees. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying.

The seedling mortality rate is increased by compaction of the surface layer because compaction limits the movement of water and air in the soil and restricts the growth of roots. The high content of rock fragments also limits seedling survival. To compensate for the higher expected mortality rate, larger seedlings or a greater number of seedlings than is typical can be planted. Shading and mulching of seedlings may be required, especially on the Huntrock soil. The trees that are suitable for planting include ponderosa pine and Douglas-fir.

Trees are subject to windthrow because of the limited rooting depth in the Huntrock soil. Regeneration systems that isolate single trees or groups of trees are not practical because of the hazard of windthrow.

Some decline in forest productivity may result from fire of moderate intensity on the Huntrock soil.

Grazable woodland.—This unit is suitable for use as grazable woodland. The understory consists mainly of common snowberry, spirea, low Oregongrape, elk sedge, pinegrass, and strawberry. The potential production of the native understory plants in a normal year is about 800 pounds of air-dry forage per acre.

A system that results in proper grazing use is essential if livestock graze this unit. Timely deferment of grazing is needed to allow the desirable plants to mature and set seed. Grazing should be delayed in spring until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.

Seeding disturbed areas to suitable plants increases forage production. Deferred grazing is needed during periods when seedlings are becoming established.

This soil can produce adequate forage for big game animals after the tree canopy is opened by logging, fire, or some other disturbance. Dense stands of timber should be left in some areas to provide escape and thermal cover for the big game animals.

The Highhorn and the Huntrock soils are in the Pine-Fir-Sedge woodland understory site.

74E—Highhorn-Huntrock very gravelly silt loams, 30 to 50 percent south slopes. This map unit is on mountains. Areas are irregular in shape and are 100 to 400 acres in size. The native vegetation is mainly conifers, shrubs, and grasses. Elevation is 3,800 to 7,200 feet. The average annual precipitation is 20 to 30 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 45 to 90 days.

This unit is about 55 percent Highhorn very gravelly silt loam and 35 percent Huntrock very gravelly silt loam. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of soils that are similar to the Huntrock soil but are less than 20 inches deep over bedrock. Also included are small areas of Rock outcrop. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

The Highhorn soil is deep and well drained. It formed in colluvium derived from argillite and influenced by volcanic ash in the surface layer. Typically, the surface layer is black and very dark brown very gravelly silt loam about 9 inches thick. The upper 23 inches of the subsoil is brown very gravelly silty clay loam. The lower 11 inches is yellowish brown extremely gravelly silty clay loam. The depth to bedrock is 40 to 60 inches.

Permeability is moderate to a depth of about 9 inches in the Highhorn soil and moderately slow below that depth. Available water capacity is 3 to 7 inches. The effective rooting depth is 40 to 60 inches. Runoff is rapid, and the hazard of water erosion is high.

The Huntrock soil is moderately deep and well drained. It formed in colluvium derived from argillite and influenced by volcanic ash in the surface layer. Typically, the surface layer is very dark brown very gravelly silt loam about 12 inches thick. The upper 13 inches of the subsoil is dark brown extremely gravelly clay loam. The lower 10 inches is yellowish brown extremely cobbly clay loam. The depth to bedrock is 20 to 40 inches.

Permeability is moderate to a depth of about 12 inches in the Huntrock soil and moderately slow below that depth. Available water capacity is 2 to 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 mainly for timber production and livestock grazing. It also provides habitat for many kinds of wildlife.

Woodland.—The Highhorn soil is suited to the production of ponderosa pine and Douglas-fir. The mean site index is 77 for ponderosa pine (100-year base age) and 63 for Douglas-fir (50-year base age). The potential production at culmination of the mean annual increment for ponderosa pine is 64 cubic feet per acre per year (4.5 cubic meters per hectare per year) in a 50-year-old, even-aged, fully stocked stand and for Douglas-fir is 49 cubic feet per year (3.4 cubic meters per hectare per year) in a 108-year-old, even-aged, fully stocked stand.

The Huntrock soil is suited to the production of ponderosa pine and Douglas-fir. The mean site index is 61 for ponderosa pine (100-year base age) and 62 for Douglas-fir (50-year base age). The potential production at culmination of the mean annual increment for ponderosa pine is 47 cubic feet per acre per year (3.3 cubic meters per hectare per year) in a 50-year-old, even-aged, fully stocked stand, and for Douglas-fir is 47 cubic feet per acre per year (3.3 cubic meters per hectare per year) in a 109-year-old, even-aged, fully stocked stand.

The main concerns in producing and harvesting timber are the hazard of erosion, the equipment limitation, seedling mortality, the hazard of windthrow, plant competition, and fire damage to the soil.

Minimizing the risk of erosion is essential in areas where timber is harvested. Properly designed road drainage systems that include carefully located culverts help to control erosion. Spoil from excavations is subject to rill and gully erosion and to sloughing. Roads, landings, skid trails, and firebreaks can be protected against erosion by constructing water bars and by seeding areas that have been cut and filled. Buffer strips may be needed in areas adjacent to perennial streams to minimize siltation and maintain stream temperatures.

The slope restricts the use of wheeled or tracked equipment. Cable yarding systems that partially or fully suspend logs are the most suitable and generally do less damage to the soil than conventional ground-based systems.

The seedling mortality rate is increased by compaction of the surface layer because compaction limits the movement of water and air in the soil and restricts the growth of roots. The high content of rock fragments also limits seedling survival. To compensate for the higher expected mortality rate, larger seedlings or a greater number of seedlings than is typical can be planted. Shading and mulching of seedlings may be required, especially on the Huntrock soil. The trees that are suitable for planting include ponderosa pine and Douglas-fir.

Trees are subject to windthrow because of the limited rooting depth in the Huntrock soil. Regeneration systems that isolate single trees or groups of trees are not practical because of the hazard of windthrow.

Some decline in soil productivity may result from fire of moderate intensity on the Huntrock soil.

Grazable woodland.—This unit is suitable for use as grazable woodland. The understory consists mainly of pine grass and elk sedge. It also includes varying amounts of common snowberry, spirea, strawberry, and low Oregongrape. The potential production of the native understory plants in a normal year is about 800 pounds of air-dry forage per acre.

A system that results in proper grazing use is essential if livestock graze this unit. Timely deferment of grazing is needed to allow the desirable plants to mature and set seed. Grazing in the spring should be delayed until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.

Seeding disturbed areas to suitable plants increases forage production. Deferred grazing is needed during periods when seedlings are becoming established.

This soil can produce adequate forage for big game animals after the tree canopy is opened by logging, fire, or some other disturbance. Dense stands of timber should be left in some areas to provide escape and thermal cover for the big game amimals.

The Highhorn and Huntrock soils are in the Pine-Fir-Sedge woodland understory site.

75D—Hudspeth very stony clay loam, 12 to 35 percent south slopes. This moderately deep, well drained soil is on the side slopes of mountains. It formed in colluvium derived from tuffaceous sediments over metamorphic bedrock. Areas are irregular in shape and are 80 to 400 acres in size. The native vegetation is mainly shrubs, bunchgrasses, forbs, and a few scattered trees. Elevation is 4,000 to 5,700 feet. The average annual precipitation is 16 to 30 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 50 to 90 days.

Typically, the surface layer is very dark grayish brown very stony clay loam about 7 inches thick. The subsoil is dark brown and dark yellowish brown very or extremely gravelly clay about 27 inches thick. The depth to bedrock is 20 to 40 inches.

Included in this unit are small areas of Harlow, Derringer, and Morningstar soils. Also included are small areas of Rock outcrop. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is slow in the Hudspeth soil. Available water capacity is 2 to 4 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 mainly for livestock grazing. It also is used for timber production, and it provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on this unit is dominated by curlleaf mountainmahogany, bluebunch wheatgrass, western juniper, and antelope bitterbrush.

Bluebunch wheatgrass is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 1,300 pounds per acre in favorable years and 600 pounds per acre in unfavorable years. Livestock access is limited by the Rock outcrop and the stones on the surface.

If the condition of the site deteriorates through overgrazing, bluebunch wheatgrass loses vigor and decreases in extent. Perennial forbs and shrubs increase in extent. If deterioration continues, the extent of Idaho fescue decreases. Severe deterioration of the understory because of concentrations of deer and elk in winter and early spring or cattle in summer, or both, increases the extent of mountainmahogany, low-value forbs, and juniper.

Mechanical treatment for brush control and for range seeding is not practical because of the stony surface and the Rock outcrop.

Woodland.—This unit is poorly suited to the production of ponderosa pine. The mean site index is 50 for ponderosa pine (100-year base age). The potential production at culmination of the mean annual increment for ponderosa pine is 38 cubic feet per acre per year (2.7 cubic meters per hectare per year) in a 60-year-old, even-aged, fully stocked stand.

The Hudspeth soil is in the Mahogany Rockland 12+pz range site.

76D—Hudspeth-Morningstar complex, 12 to 35 percent south slopes. This map unit is on mountains. Areas are irregular in shape and are 100 to 400 acres in size. The native vegetation is mainly conifers, shrubs, and grasses. Elevation is 4,000 to 5,700 feet. The average annual precipitation is 16 to 30 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 50 to 90 days.

This unit is about 45 percent Hudspeth very stony clay loam and 40 percent Morningstar extremely gravelly loam. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of Derringer and Harlow soils. Also included are small areas of Rock outcrop. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Hudspeth soil is moderately deep and well drained. It formed in colluvium derived from tuffaceous sediments over metamorphic bedrock. Typically, the surface layer is very dark grayish brown very stony clay loam about 7 inches thick. The subsoil is dark brown and dark yellowish brown very or extremely gravelly clay about 27 inches thick. The depth to bedrock is 20 to 40 inches.

Permeability is slow in the Hudspeth soil. Available water capacity is 2 to 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate or high.

The Morningstar soil is deep and well drained. It formed in colluvium derived from argillite and rhyolitic tuff. Typically, the surface layer is very dark grayish brown extremely gravelly loam about 6 inches thick. The next layer is extremely gravelly clay loam about 9 inches thick. The upper 8 inches of the subsoil is brown extremely gravelly clay loam. The lower 23 inches is dark yellowish brown extremely gravelly sandy clay loam. The substratum to a depth of 60 inches or more is brown extremely gravelly sandy clay loam.

Permeability is moderately slow in the Morningstar soil. Available water capacity is 3 to 7 inches. The effective rooting depth is typically 60 inches or more but is 40 to 60 inches in some areas. Runoff is medium, and the hazard of water erosion is moderate or high.

This unit is used mainly for livestock grazing. It also is used for timber production, and it provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on the Hudspeth soil is dominated by curlleaf mountainmahogany, bluebunch wheatgrass, western juniper, and antelope bitterbrush.

Bluebunch wheatgrass is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 1,300 pounds per acre in favorable years and 600 pounds per acre in unfavorable years. Livestock access is limited by the Rock outcrop and the rock fragments on the surface.

If the condition of the site deteriorates through overgrazing, bluebunch wheatgrass loses vigor and decreases in extent. Perennial forbs and shrubs increase in extent. If deterioration continues, the extent of Idaho fescue decreases. Severe deterioration of the understory because of concentrations of deer and elk in winter and early spring or cattle in summer, or both, increases the extent of mountainmahogany, low-value forbs, and juniper.

Mechanical treatment for brush control and range seeding is not practical because of the stony surface and the Rock outcrop.

Woodland.—The Morningstar soil is suited to the production of ponderosa pine. The mean site index is 69 for ponderosa pine (100-year base age). The potential production at culmination of the mean annual increment for ponderosa pine is 54 cubic feet per acre per year (3.8 cubic meters per hectare per year) in a 50-year-old, even-aged, fully stocked stand.

The Hudspeth soil is poorly suited to the production of ponderosa pine. The mean site index is 50 for ponderosa pine (100-year base age). The potential production at culmination of the mean annual increment is 38 cubic feet per acre per year (2.7 cubic meters per hectare per year) in a 60-year-old, even-aged, fully stocked stand.

The main concerns in producing and harvesting timber are the hazard of erosion, the equipment limitation, seedling mortality, plant competition, the hazard of windthrow, and fire damage to the soil.

Minimizing the risk of erosion is essential in areas where timber is harvested. Properly designed road drainage systems that include carefully located culverts help to control erosion. Spoil from excavations is subject to rill and gully erosion and to sloughing. Roads, landings, skid trails, and firebreaks can be protected against erosion by constructing water bars and by seeding areas that have been cut and filled. Buffer strips may be needed in areas adjacent to perennial streams to minimize siltation and maintain stream temperatures.

Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. The risk of compaction can be reduced by using low-pressure ground equipment, laying out skid trails in advance, and harvesting timber when the soil is dry or frozen. Compaction limits the movement of water and air in the soil and restricts the growth of roots. Cable yarding systems that partially or fully suspend logs generally do less damage to the soil than conventional ground-based systems.

Careful management of reforestation is needed to minimize competition from undesirable plants. If the site is not adequately prepared, plant competition can prevent or delay reestablishment of volunteer or planted trees. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying.

The seedling mortality rate is increased by compaction of the surface layer. The high content of rock fragments also limits seedling survival. To compensate for the higher expected mortality rate, larger seedlings or a greater number of seedlings than is typical can be planted. Shading and mulching of seedlings may be required. The trees that are suitable for planting include ponderosa pine.

Trees are subject to windthrow on the Hudspeth soil. Regeneration systems that isolate single trees or groups of trees are not practical because of the hazard of windthrow.

Some decline in forest productivity may result from fire of moderate intensity on this map unit.

Grazable woodland.—The Morningstar soil is suitable for use as grazable woodland. The understory consists mainly of common snowberry, antelope bitterbrush, mountain big sagebrush, bluebunch wheatgrass, Idaho fescue, and western juniper. The potential production of the native understory plants in a normal year is about 800 pounds of air-dry forage per acre.

This soil can produce adequate forage for big game animals after the tree canopy is opened by logging, fire, or some other disturbance. It is commonly an important natural winter and spring range for big game animals. Stands of timber should be left in some areas to provide escape and thermal cover for the big game animals.

The Hudspeth soil is in the Mahogany Rockland 12+pz range site. The Morningstar soil is in the Pine-Bitterbrush-Fescue woodland understory site.

76E—Hudspeth-Morningstar complex, 35 to 60 percent south slopes. This map unit is on mountains. Areas are irregular in shape and are 100 to 400 acres in size. The native vegetation is mainly conifers, shrubs, and grasses. Elevation is 4,000 to 5,700 feet. The average annual precipitation is 16 to 30 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 50 to 90 days.

This unit is about 55 percent Hudspeth very stony clay loam and 30 percent Morningstar extremely gravelly loam. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of Derringer and Harlow soils. Also included are small areas of Rock outcrop. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Hudspeth soil is moderately deep and well drained. It formed in colluvium derived from tuffaceous sediments over metamorphic bedrock. Typically, the surface layer is very dark grayish brown very stony clay loam about 7 inches thick. The subsoil is dark brown and dark yellowish brown very or extremely gravelly clay about 27 inches thick. The depth to bedrock is 20 to 40 inches.

Permeability is slow in the Hudspeth soil. Available water capacity is 2 to 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high or very high.

The Morningstar soil is deep and well drained. It formed in colluvium derived from argillite and rhyolitic tuff. Typically, the surface layer is very dark grayish brown extremely gravelly loam about 6 inches thick. The next layer is dark brown extremely gravelly clay loam about 9 inches thick. The upper 8 inches of the subsoil is brown extremely gravelly clay loam. The lower 23 inches is dark yellowish brown extremely gravelly sandy clay loam. The substratum to a depth of 60 inches or more is brown extremely gravelly sandy clay loam.

Permeability is moderately slow in the Morningstar soil. Available water capacity is 3 to 7 inches. The effective rooting depth is typically 60 inches or more but is 40 to 60 inches in some areas. Runoff is rapid, and the hazard of water erosion is high.

This unit is used mainly for livestock grazing. It also is used for timber production, and it provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on the Hudspeth soil is dominated by curlleaf mountainmahogany, bluebunch wheatgrass, western juniper, and antelope bitterbrush.

Bluebunch wheatgrass is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 1,300 pounds per acre in favorable years and 600 pounds per acre in unfavorable years. Livestock access is limited by the Rock outcrop, the slope, and the stones on the surface.

If the condition of the site deteriorates through overgrazing, bluebunch wheatgrass loses vigor and decreases in extent. Perennial forbs and shrubs increase in extent. If deterioration continues, the extent of Idaho fescue decreases. Severe deterioration of the understory because of concentrations of deer and elk in winter and early spring or cattle in summer, or both, increases the extent of mountainmahogany, low-value forbs, annuals, and juniper.

Mechanical treatment for brush control and for range seeding is not practical because of the stony surface and the Rock outcrop.

Woodland.—The Morningstar soil is suited to the production of ponderosa pine. The mean site index is 69 for ponderosa pine (100-year base age). The potential production at culmination of the mean annual increment for ponderosa pine is 54 cubic feet per acre per year (3.8 cubic meters per hectare per year) in a 50-year-old, even-aged, fully stocked stand.

The Hudspeth soil is poorly suited to the production of ponderosa pine. The mean site index is 50 for ponderosa pine (100-year base age). The potential production at culmination of the mean annual increment is 38 cubic feet per acre per year (2.7 cubic meters per hectare per year) in a 60-year-old, even-aged, fully stocked stand.

The main concerns in producing and harvesting timber are the hazard of erosion, the equipment limitation, seedling mortality, plant competition, the hazard of windthrow, and fire damage to the soil.

Minimizing the risk of erosion is essential in areas where timber is harvested. Properly designed road drainage systems that include carefully located culverts help to control erosion. Spoil from excavations is subject to rill and gully erosion and to sloughing. Roads, landings, skid trails, and firebreaks can be protected against erosion by constructing water bars and by seeding areas that have been cut and filled. Buffer strips may be needed in areas adjacent to perennial streams to minimize siltation and maintain stream temperatures.

The slope restricts the use of wheeled and tracked equipment on skid trails. High-lead or other logging systems that fully or partially suspend the logs above the ground will damage the soil less than tractor systems and reduce the risk of compaction. The risk of compaction also can be reduced by using low-pressure ground equipment, laying out skid trails in advance, and harvesting timber when the soil is dry or frozen.

Careful management of reforestation is needed to minimize competition from undesirable plants. If the site is not adequately prepared, plant competition can prevent or delay reestablishment of volunteer or planted trees. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying. Scarification is severely restricted in the steeper areas because of increased expense and soil displacement.

The seedling mortality rate is increased by compaction of the surface layer. The high content of rock fragments also limits seedling survival. To compensate for the higher expected mortality rate, larger seedlings or a greater number of seedlings than is typical can be planted. Shading and mulching of seedlings may be required. The trees that are suitable for planting include ponderosa pine.

Trees are subject to windthrow because of the limited rooting depth in the Hudspeth soil. Regeneration systems utilizing single trees or groups of trees are not practical because of the hazard of windthrow.

Some decline in forest productivity may result from fire of moderate intensity on this map unit.

Grazable woodland.—The Morningstar soil is suitable for use as grazable woodland. The understory consists mainly of common snowberry, antelope bitterbrush, mountain big sagebrush, bluebunch wheatgrass, Idaho fescue, and western juniper. The potential production of the native understory plants in a normal year is about 800 pounds of air-dry forage per acre.

This soil can produce adequate forage for big game animals after the tree canopy is opened by logging, fire, or some other disturbance. It is commonly an important natural winter and spring range for big game animals. Stands of timber should be left in some areas to provide escape and thermal cover for the big game animals.

The Hudspeth soil is in the Mahogany Rockland 12+pz range site. The Morningstar soil is in the Pine-Bitterbrush-Fescue woodland understory site.

77F—Huntrock-Highhorn very gravelly silt loams, 50 to 75 percent south slopes. This map unit is on mountains. Areas are irregular in shape and are 200 to 800 acres in size. The native vegetation is mainly conifers, shrubs, and grasses. Elevation is 3,800 to 7,200 feet. The average annual precipitation is 20 to 30 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 45 to 90 days.

This unit is about 50 percent Huntrock very gravelly silt loam and 40 percent Highhorn very gravelly silt loam. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of soils that are similar to the Huntrock soil but are less than 20 inches deep over bedrock. Also included are small areas of Rock outcrop. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

The Huntrock soil is moderately deep and well drained. It formed in colluvium derived from argillite and influenced by volcanic ash in the surface layer. Typically, the surface layer is very dark brown very gravelly silt loam about 12 inches thick. The upper 13 inches of the subsoil is dark brown gravelly clay loam. The lower 10 inches is yellowish brown extremely cobbly clay loam. The depth to bedrock is 20 to 40 inches.

Permeability is moderate to a depth of about 12 inches in the Huntrock soil and moderately slow below that depth. Available water capacity is 2 to 5 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is very high.

The Highhorn soil is deep and well drained. It formed in colluvium derived from argillite and influenced by volcanic ash in the surface layer. Typically, the surface layer is black and very dark brown very gravelly silt loam about 9 inches thick. The upper 23 inches of the subsoil is brown very gravelly silty clay loam. The lower 11 inches is yellowish brown extremely gravelly silty clay loam. The depth to bedrock is 40 to 60 inches.

Permeability is moderate to a depth of about 9 inches in the Highhorn soil and moderately slow below that depth. Available water capacity is 3 to 7 inches. The effective rooting depth is 40 to 60 inches. Runoff is rapid, and the hazard of water erosion is very high.

This unit is used mainly for timber production. It also is used for water supply, and it provides habitat for many kinds of wildlife.

Woodland.—The Huntrock soil is suited to the production of ponderosa pine and Douglas-fir. The mean site index is 61 for ponderosa pine (100-year base age) and 62 for Douglas-fir (50-year base age). The potential production at culmination of the mean annual increment for ponderosa pine is 47 cubic feet per acre per year (3.3 cubic meters per hectare per year) in a 50-year-old, even-aged, fully stocked stand and for Douglas-fir is 47 cubic feet per acre per year (3.3 cubic meters per hectare per year) in a 109-year-old, even-aged, fully stocked stand.

The Highhorn soil is suited to the production of ponderosa pine and Douglas-fir. The mean site index is 77 for ponderosa pine (100-year base age) and 63 for Douglas-fir (50-year base age). The potential production at culmination of the mean annual increment for ponderosa pine is 64 cubic feet per acre per year (3.6 cubic meters per hectare per year) in a 50-year-old, even-aged, fully stocked stand and for Douglas-fir is 49 cubic feet per acre per year (3.4 cubic meters per hectare per year) in a 108-year-old, even-aged, fully stocked stand.

The main concerns in producing and harvesting timber are the hazard of erosion, the equipment limitation, seedling mortality, the hazard of windthrow, plant competition, and fire damage to the soil.

Minimizing the risk of erosion is essential in areas where timber is harvested. Properly designed road drainage systems that include carefully located culverts help to control erosion. Spoil from excavations is subject to rill and gully erosion and to sloughing. Roads, landings, skid trails, and firebreaks can be protected against erosion by constructing water bars and by seeding areas that have been cut and filled. Buffer strips may be needed in areas adjacent to perennial streams to minimize siltation and maintain stream temperatures.

The slope prevents the use of wheeled or tracked equipment. Harvesting systems that fully suspend the logs above the ground are most suitable and reduce the disturbance of the protective layer of duff.

The high content of rock fragments limits seedling survival. To compensate for the higher expected mortality rate, larger seedlings or a greater number of seedlings than is typical can be planted. Shading and mulching of seedlings may be required, especially on the Huntrock soil. The trees that are suitable for planting include ponderosa pine and Douglas-fir.

Trees are subject to windthrow because of the limited rooting depth in the Huntrock soil. Regeneration systems that isolate single trees or groups of trees are not practical because of the hazard of windthrow.

Some decline in soil productivity may result from fire of moderate intensity on the Huntrock soil.

The understory consists mainly of pinegrass and elk sedge. It also includes varying amounts of common snowberry, spirea, strawberry, and low Oregongrape.

The Huntrock and Highhorn soils are in the Pine-Fir-Sedge woodland understory site.

78E—Hyall-Badland complex, 35 to 60 percent south slopes. This map unit is on terrace side slopes. Areas are irregular in shape and are 40 to 200 acres in size. The native vegetation is mainly bunchgrasses, forbs, and shrubs. Elevation is 2,700 to 3,500 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 120 days.

This unit is about 45 percent Hyall very gravelly clay loam and 40 percent Badland. Both components are so intermingled on south-facing slopes that it was not practical to map them separately.

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

The Hyall soil is deep over bedrock and moderately deep to consolidated, gravelly alluvium and is well drained. It formed in mixed alluvium. Typically, the surface layer is very dark grayish brown very gravelly clay loam about 3 inches thick. The next layer is very dark grayish brown very gravelly clay about 5 inches thick. The upper 6 inches of the subsoil is dark brown very gravelly clay. The lower 12 inches is dark brown extremely gravelly clay. The substratum to a depth of about 60 inches is multicolored, strongly consolidated extremely gravelly loamy sand. Depth to the strongly consolidated, gravelly alluvium is 20 to 40 inches.

Permeability is slow in the Hyall soil. Available water capacity is 3 to 6 inches. The effective rooting depth is limited by the strongly consolidated, gravelly alluvium at a depth of 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

The Badland is dominated by exposed silty, clayey, or gravelly alluvial sediments on terrace escarpments. These areas are badly eroded and nearly barren of vegetation. Runoff is rapid, and the hazard of water erosion is high or very high.

This unit is used mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on the Hyall soil is dominated by bluebunch wheatgrass and Wyoming big sagebrush.

Bluebunch wheatgrass is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 1,200 pounds per acre in favorable years and 400 pounds per acre in unfavorable years. Livestock access is limited by the slope.

If the condition of the site deteriorates through overgrazing, bluebunch wheatgrass loses vigor and decreases in extent. Sandberg bluegrass, Wyoming big sagebrush, and gray rabbitbrush increase in extent. If deterioration continues, annual grasses and forbs invade the site.

Mechanical treatment for brush control and range seeding is not practical because of the slope.

Badland is unsuitable for livestock grazing and is best left in its natural state.

The Hyall soil is in the Clayey South 9-12pz range site.

79D—Hyall-Simas association, 12 to 35 percent slopes. This map unit is on terrace side slopes. Areas are irregular in shape and are 100 to 400 acres in size. The native vegetation is mainly bunchgrasses, forbs, and shrubs. Elevation is 2,700 to 3,500 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 120 days.

This unit is about 45 percent Hyall very gravelly clay loam and 40 percent Simas gravelly silty clay loam. The Hyall soils are on south and west aspects, and the Simas soils are on east and north aspects.

Included in this unit are small areas of soils that are similar to the Simas soil but have more than 35 percent rock fragments. These soils are on north-facing slopes. Also included are small areas of Badland on south-facing slopes. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Hyall soil is deep over bedrock and moderately deep to strongly consolidated, gravelly alluvium and is well drained. It formed in mixed alluvium. Typically, the surface layer is very dark grayish brown very gravelly clay loam about 3 inches thick. The next layer is very dark grayish brown very gravelly clay about 5 inches thick. The upper 6 inches of the subsoil is dark brown very gravelly clay. The lower 12 inches is dark brown extremely gravelly clay. The substratum to a depth of 60 inches or more is multicolored, strongly consolidated extremely gravelly loamy sand. Depth to the strongly consolidated, gravelly alluvium is 20 to 40 inches.

Permeability is slow in the Hyall soil. Available water capacity is 3 to 6 inches. The effective rooting depth is limited by the strongly consolidated, gravelly alluvium at 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate or high.

The Simas soil is deep and well drained. It formed in mixed alluvium. Typically, the surface layer is very dark grayish brown gravelly silty clay loam about 14 inches thick. The subsoil is about 34 inches of dark brown clay and silty clay. Below this to a depth of 60 inches or more is dark brown clay loam.

Permeability is moderate to a depth of about 14 inches in the Simas soil and slow below that depth. Available water capacity is 6 to 9 inches. The effective rooting depth is 10 to 20 inches; root penetration is limited by the dense clay subsoil. Runoff is medium, and the hazard of water erosion is moderate or high.

This unit is used mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on the Hyall soil is dominated by bluebunch wheatgrass and Wyoming big sagebrush.

Bluebunch wheatgrass is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 1,200 pounds per acre in favorable years and 400 pounds per acre in unfavorable years.

The potential plant community on the Simas soil is dominated by Idaho fescue, bluebunch wheatgrass, and Wyoming big sagebrush.

Idaho fescue and bluebunch wheatgrass are the major forage-producing plants. If the site is in excellent condition, the total annual production is estimated at 1,700 pounds per acre in favorable years and 600 pounds per acre in unfavorable years.

If the condition of the site deteriorates through overgrazing, bluebunch wheatgrass and Idaho fescue lose vigor and decrease in extent. Sandberg bluegrass, big sagebrush, and gray rabbitbrush increase in extent. If deterioration continues, the extent of unpalatable perennial forbs increases and cheatgrass, soft brome, and other annual plants invade the site.

The Hyall soil is in the Clayey South 9-12pz range site. The Simas soil is in the North 9-12pz range site.

80E—Hyall-Simas association, 35 to 60 percent slopes. This map unit is on terrace side slopes. Areas are irregular in shape and are 100 to 400 acres in size. The native vegetation is mainly bunchgrasses, forbs, and shrubs. Elevation is 2,700 to 3,500 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 120 days.

This unit is about 45 percent Hyall very gravelly clay loam and 40 percent Simas gravelly silty clay loam. The Hyall soils are on south and west aspects, and the Simas soils are on east and north aspects.

Included in this unit are small areas of soils that are similar to the Simas soil but have more than 35 percent rock fragments. These soils are on north-facing slopes. Also included are small areas of Badland on south-facing slopes. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Hyall soil is deep over bedrock and moderately deep to strongly consolidated, gravelly alluvium and is well drained. It formed in mixed alluvium. Typically, the surface layer is very dark grayish brown very gravelly clay loam about 3 inches thick. The upper 11 inches of the subsoil is dark grayish brown very gravelly clay. The lower 12 inches is dark brown extremely gravelly clay. The substratum to a depth of 60 inches or more is multicolored, strongly consolidated extremely gravelly loamy sand. Depth to the strongly consolidated, gravelly alluvium is 20 to 40 inches.

Permeability is slow in the Hyall soil. Available water capacity is 3 to 6 inches. The effective rooting depth is limited by the strongly consolidated, gravelly alluvium at 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high or very high.

The Simas soil is deep and well drained. It formed in mixed alluvium. Typically, the surface layer is very dark grayish brown gravelly silty clay loam about 14 inches thick. The subsoil is about 34 inches of dark brown clay and silty clay. Below this to a depth of 60 inches or more is brown clay loam.

Permeability is moderate to a depth of about 14 inches in the Simas soil and slow below that depth. Available water capacity is 6 to 9 inches. The effective rooting depth is 10 to 20 inches; root penetration is limited by the dense clay subsoil. Runoff is rapid, and the hazard of water erosion is high or very high.

This unit is used mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on the Hyall soil is dominated by bluebunch wheatgrass and Wyoming big sagebrush.

Bluebunch wheatgrass is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 1,200 pounds per acre in favorable years and 400 pounds per acre in unfavorable years. Livestock access is limited by the slope.

The potential plant community on the Simas soil is dominated by Idaho fescue, bluebunch wheatgrass, and Wyoming big sagebrush.

Idaho fescue and bluebunch wheatgrass are the major forage-producing plants. If the site is in excellent condition, the total annual production is estimated at 1,700 pounds per acre in favorable years and 600 pounds per acre in unfavorable years. Livestock access is limited by the slope.

If the condition of the site deteriorates through overgrazing, bluebunch wheatgrass and Idaho fescue lose vigor and decrease in extent. Sandberg bluegrass, big sagebrush, and gray rabbitbrush increase in extent. If deterioration continues, the extent of unpalatable perennial forbs increases and cheatgrass, soft brome, and other annual plants invade the site.

Mechanical treatment for brush control and range seeding is not practical because of the slope.

The Hyall soil is in the Clayey South 9-12pz range site. The Simas soil is in the North 9-12pz range site.

81C—Immig silt loam, 2 to 12 percent slopes. This moderately deep, well drained soil is on hills. It formed in colluvium derived from basalt and influenced by loess and volcanic ash in the surface layer. Areas are irregular in shape and are 40 to 200 acres in size. The native vegetation is mainly bunchgrasses, shrubs, and forbs. Elevation is 2,000 to 4,000 feet. The average annual precipitation is 14 to 20 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 120 days.

Typically, the surface layer is very dark grayish brown silt loam about 7 inches thick. The next layer is dark brown very cobbly silty clay loam about 5 inches thick. The upper part of the subsoil is dark brown very cobbly clay about 10 inches thick. The lower part is olive brown extremely cobbly clay about 4 inches thick. The depth to bedrock is 20 to 40 inches.

Included in this unit are small areas of Immig very cobbly silt loam and Gwinly soils. Also included are small areas of soils that are similar to the Immig soil but are more than 40 inches deep over bedrock. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderately slow to a depth of about 7 inches in the Immig soil and slow below that depth. Available water capacity is 2 to 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.

This unit is used mainly for livestock grazing and irrigated hay and pasture. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on this unit is dominated by Idaho fescue and bluebunch wheatgrass

Idaho fescue and bluebunch wheatgrass are the major forage-producing plants. If the site is in excellent condition, the total annual production is estimated at 1,200 pounds per acre in favorable years and 400 pounds per acre in unfavorable years.

If the condition of the site deteriorates through overgrazing, Idaho fescue loses vigor and decreases in extent. Bluebunch wheatgrass and Sandberg bluegrass increase in extent. If overgrazing continues, the extent of bluebunch wheatgrass decreases and bulbous bluegrass and other annuals invade the site.

Hay and pasture.—If this unit is used for hay and pasture, the main limitations are the droughtiness because of the large rock fragment content, a limited depth to bedrock, and the slope on the steeper part of this unit.

In summer irrigation is needed for the maximum production of most crops. Irrigation water can be applied by the controlled surface and sprinkler methods. To avoid 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.

Fertilizer is needed to ensure the optimum growth of grasses and legumes.

Management that maintains the optimum vigor and quality of forage plants is needed. A seedbed 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 the pasture in good condition and control erosion. Periodic mowing and clipping help to maintain uniform growth and prevent selective grazing.

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. Conducting fieldwork during wet periods results in deterioration of tilth and destroys soil structure. As a result, it increases the runoff rate and the hazard of erosion. Compaction limits the movement of air and water in the soil and restricts the growth of roots.

The Immig soil is in the Clayey 14-17pz range site.

82C—Immig very cobbly silt loam, 2 to 12 percent slopes. This moderately deep, well drained soil is on hills. It formed in colluvium derived from basalt and influenced by loess and volcanic ash in the surface layer. Areas are irregular in shape and are 40 to 200 acres in size. The native vegetation is mainly bunchgrasses, shrubs, and forbs. Elevation is 2,000 to 4,000 feet. The average annual precipitation is 14 to 20 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 120 days.

Typically, the surface layer is very dark grayish brown very cobbly silt loam about 7 inches thick. The next layer is dark brown very cobbly silty clay loam about 5 inches thick. The upper part of the subsoil is dark brown very cobbly clay about 10 inches thick. The lower part is olive brown extremely cobbly clay about 4 inches thick. The depth to bedrock is 20 to 40 inches.

Included in this unit are small areas of Gwinly and Rockly soils. Also included are small areas of Immig silt loam and a soil similar to the Immig soil but is deeper than 40 inches to bedrock. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderately slow to a depth of about 7 inches in the Immig soil and slow below that depth. Available water capacity is 2 to 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is slow, and the hazard of water erosion is slight or moderate.

This unit is used mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on this unit is dominated by Idaho fescue and bluebunch wheatgrass.

Idaho fescue and bluebunch wheatgrass are the major forage-producing plants. If the site is in excellent condition, the total annual production is estimated at 1,200 pounds per acre in favorable years and 400 pounds per acre in unfavorable years. Livestock access is limited by the very cobbly surface.

If the condition of the site deteriorates through overgrazing, Idaho fescue loses vigor and decreases in extent. Bluebunch wheatgrass and Sandberg bluegrass increase in extent. If overgrazing continues, the extent of bluebunch wheatgrass decreases and bulbous bluegrass and other annuals invade the site.

Mechanical treatment for brush control and range seeding is not practical because of the very cobbly surface.

The Immig soil is in the Clayey 14-17pz range site.

83D—Inkler very gravelly loam, 2 to 35 percent north slopes. This deep, well drained soil is on mountains. It formed in colluvium derived from rhyolite and andesite and influenced by volcanic ash in the surface layer. Areas are irregular in shape and are 80 to 400 acres in size. The native vegetation is mainly conifers, shrubs, bunchgrasses, and forbs. Elevation is 4,000 to 6,000 feet. The average annual precipitation is 20 to 30 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 30 to 60 days.

Typically, the surface layer is very dark brown very gravelly loam about 4 inches thick. The upper part of the subsoil is dark brown very gravelly loam about 8 inches thick. The lower part is brown extremely gravelly loam about 11 inches thick. The substratum to a depth of about 62 inches is brown extremely cobbly loam and extremely gravelly sandy loam.

Included in this unit are small areas of Brannan and Piersonte soils. Also included are small areas of Crackler and Rouen soils. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate in the Inkler soil. Available water capacity is 5 to 10 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 mainly for timber production. It also is used for livestock grazing, and it provides habitat for many kinds of wildlife.

Woodland.—This unit is suited to the production of Douglas-fir and ponderosa pine. The mean site index is 61 for Douglas-fir (50-year base age) and 64 for ponderosa pine (100-year base age). The potential production at culmination of the mean annual increment for Douglas-fir is 46 cubic feet per acre per year (3.2 cubic meters per hectare per year) in a 109-year-old, even-aged, fully stocked stand and for ponderosa pine is 50 cubic feet per acre per year (3.5 cubic meters per hectare per year) in a 55-year-old, even-aged, fully stocked stand.

The main concerns in producing and harvesting timber are the hazard of erosion, the equipment limitation, seedling mortality, plant competition, and fire damage to the soil.

Minimizing the risk of erosion is essential in areas where timber is harvested. Properly designed road drainage systems that include carefully located culverts help to control erosion. Spoil from excavations is subject to rill and gully erosion and to sloughing. Roads, landings, skid trails, and firebreaks can be protected against erosion by constructing water bars and by seeding areas that have been cut and filled. Buffer strips may be needed in areas adjacent to perennial streams to minimize siltation and maintain stream temperatures.

Use of standard wheeled and tracked equipment is generally suitable. Displacement of the surface layer occurs most readily when the soil is dry. Maintaining the understory is essential in controlling erosion.

Careful management of reforestation is needed to minimize competition from undesirable plants. If the site is not adequately prepared, plant competition can prevent or delay reestablishment of volunteer or planted trees. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying.

The seedling mortality rate is increased by compaction of the surface layer. The high content of rock fragments also limits seedling survival. To compensate for the higher expected mortality rate, larger seedlings or a greater number of seedlings than is typical can be planted. The trees that are suitable for planting include Douglas-fir, ponderosa pine, and western larch.

Some decline in forest productivity may result from fire of moderate intensity.

Grazable woodland.—This unit is suitable for use as grazable woodland. The understory consists mainly of princes pine, low Oregongrape, myrtle pachystima, elk sedge, pinegrass, and heartleaf arnica.

A system that results in proper grazing use is essential if livestock graze this unit. Timely deferment of grazing is needed to allow the desirable plants to mature and set seed. Grazing should be delayed in spring until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.

Seeding disturbed areas to suitable plants increases forage production. Deferred grazing is needed during periods when seedlings are becoming established.

This soil can produce adequate forage for big game animals after the tree canopy is opened by logging, fire, or some other disturbance. Dense stands of timber should be left in some areas to provide escape and thermal cover for the big game animals.

The Inkler soil is in the Fir-Pine-Sedge woodland understory site.

83E—Inkler very gravelly loam, 35 to 50 percent north slopes. This deep, well drained soil is on mountains. It formed in colluvium derived from rhyolite and andesite and influenced by volcanic ash in the surface layer. Areas are irregular in shape and are 80 to 400 acres in size. The native vegetation is mainly conifers, shrubs, bunchgrasses, and forbs. Elevation is 4,000 to 6,000 feet. The average annual precipitation is 20 to 30 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 30 to 60 days.

Typically, the surface layer is very dark brown very gravelly loam about 4 inches thick. The upper part of the subsoil is dark brown very gravelly loam about 8 inches thick. The lower part is brown extremely gravelly loam about 11 inches thick. The substratum to a depth of about 62 inches is brown extremely cobbly loam and extremely gravelly sandy loam.

Included in this unit are small areas of Stices and Brannan soils. Also included are small areas of Crackler and Rouen soils. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate in the Inkler soil. Available water capacity is 5 to 10 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 mainly for timber production. It also is used for livestock grazing, and it provides habitat for many kinds of wildlife.

Woodland.—This unit is suited to the production of Douglas-fir and ponderosa pine. The mean site index is 61 for Douglas-fir (50-year base age) and 64 for ponderosa pine (100-year base age). The potential production at culmination of the mean annual increment for Douglas-fir is 46 cubic feet per acre per year (3.2 cubic meters per hectare per year) in a 109-year-old, even-aged, fully stocked stand and for ponderosa pine is 50 cubic feet per acre per year (3.5 cubic meters per hectare per year) in a 55-year-old, even-aged, fully stocked stand.

The main concerns in producing and harvesting timber are the hazard of erosion, the equipment limitation, seedling mortality, plant competition, and fire damage to the soil.

Minimizing the risk of erosion is essential in areas where timber is harvested. Properly designed road drainage systems that include carefully located culverts help to control erosion. Spoil from excavations is subject to rill and gully erosion and to sloughing. Roads, landings, skid trails, and firebreaks can be protected against erosion by constructing water bars and by seeding areas that have been cut and filled. Buffer strips may be needed in areas adjacent to perennial streams to minimize siltation and maintain stream temperatures.

The slope restricts the use of wheeled and tracked equipment. High-lead or other logging systems that fully or partially suspend logs reduce the disturbance of the protective layer of duff. The risk of compaction can be reduced by using low-pressure ground equipment, laying out skid trails in advance, and harvesting timber when the soil is dry or frozen.

Careful management of reforestation is needed to minimize competition from undesirable plants. If the site is not adequately prepared, plant competition can prevent or delay reestablishment of volunteer or planted trees. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying. Scarification is severely restricted in the steeper areas because of increased expense and soil displacement.

The seedling mortality rate is increased by compaction of the surface layer because compaction limits the movement of water and air in the soil and restricts the growth of roots. The high content of rock fragments also limits seedling survival. To compensate for the higher expected mortality rate, larger seedlings or a greater number of seedlings than is typical can be planted. The trees that are suitable for planting include Douglas-fir, ponderosa pine, and western larch.

Some decline in forest productivity may result from fire of moderate intensity.

Grazable woodland.—This unit is suitable for use as grazable woodland. The understory consists mainly of princes pine, low Oregongrape, myrtle pachystima, elk sedge, pinegrass, and heartleaf arnica.

A system that results in proper grazing use is essential if livestock graze this unit. Timely deferment of grazing is needed to allow the desirable plants to mature and set seed. Grazing should be delayed in spring until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.

This soil can produce adequate forage for big game animals after the tree canopy is opened by logging, fire, or some other disturbance. Dense stands of timber should be left in some areas to provide escape and thermal cover for the big game animals.

The Inkler soil is in the Fir-Pine-Sedge woodland understory site.

83F—Inkler very gravelly loam, 50 to 70 percent north slopes. This deep, well drained soil is on mountains. It formed in colluvium derived from rhyolite and andesite and influenced by volcanic ash in the surface layer. Areas are irregular in shape and are 80 to 400 acres in size. The native vegetation is mainly conifers, shrubs, bunchgrasses, and forbs. Elevation is 4,000 to 6,000 feet. The average annual precipitation is 20 to 30 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 30 to 60 days.

Typically, the surface layer is very dark brown very gravelly loam about 4 inches thick. The upper part of the subsoil is dark brown very gravelly loam about 8 inches thick. The lower part is brown extremely gravelly loam about 11 inches thick. The substratum to a depth of about 62 inches is brown extremely cobbly loam and extremely gravelly sandy loam.

Included in this unit are small areas of Stices and Brannan soils. Also included are small areas of Crackler and Rouen soils. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate in the Inkler soil. Available water capacity is 5 to 10 inches. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is very high.

This unit is used mainly for timber production. It also provides habitat for many kinds of wildlife.

Woodland.—This unit is suited to the production of Douglas-fir and ponderosa pine. The mean site index is 61 for Douglas-fir (50-year base age) and 64 for ponderosa pine (100-year base age). The potential production at culmination of the mean annual increment for Douglas-fir is 46 cubic feet per acre per year (3.2 cubic meters per hectare per year) in a 109-year-old, even-aged, fully stocked stand and for ponderosa pine is 50 cubic feet per acre per year (3.5 cubic meters per hectare per year) in a 55-year-old, even-aged, fully stocked stand.

The main concerns in producing and harvesting timber are the hazard of erosion, the equipment limitation, seedling mortality, plant competition, and fire damage to the soil.

Minimizing the risk of erosion is essential in areas where timber is harvested. Properly designed road drainage systems that include carefully located culverts help to control erosion. Spoil from excavations is subject to rill and gully erosion and to sloughing. Roads, landings, skid trails, and firebreaks can be protected against erosion by constructing water bars and by seeding areas that have been cut and filled. Buffer strips may be needed in areas adjacent to perennial streams to minimize siltation and maintain stream temperatures.

The slope prevents the use of wheeled and tracked equipment. High-lead or other logging systems that fully or partially suspend logs reduce the disturbance of the protective layer of duff.

Careful management of reforestation is needed to minimize competition from undesirable plants. If the site is not adequately prepared, plant competition can prevent or delay reestablishment of volunteer or planted trees. Competing weeds, brush, or trees can be controlled by spraying, cutting, or girdling.

The high content of rock fragments limits seedling survival. To compensate for the higher expected mortality rate, larger seedlings or a greater number of seedlings than is typical can be planted. The trees that are suitable for planting include Douglas-fir, ponderosa pine, and western larch.

Some decline in forest productivity may result from fire of moderate intensity.

The understory vegetation consists mainly of princes pine, low Oregongrape, myrtle pachystima, elk sedge, pinegrass, and heartleaf arnica.

This soil can produce adequate forage for big game animals after the tree canopy is opened by logging, fire, or some other disturbance. Dense stands of timber should be left in some areas to provide escape and thermal cover for the big game animals.

The Inkler soil is in the Fir-Pine-Sedge woodland understory site.

84D—Jett silt loam, 0 to 3 percent slopes. This deep, well drained soil is on flood plains. It formed in mixed alluvium that has a large content of volcanic ash. Areas are elongated and are 20 to 80 acres in size. The native vegetation is mainly bunchgrasses, shrubs, and forbs. Elevation is 2,200 to 3,600 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 115 to 150 days.

Typically, the surface layer is black silt loam about 24 inches thick. The upper part of the substratum is very dark brown silt loam about 14 inches thick. The lower part to a depth of 60 inches or more is very dark grayish brown and dark brown silt loam.

Included in this unit are small areas of Powval and Wingville soils. Also included are small areas of soils that are similar to the Jett soil but are moderately well drained. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate in the Jett soil. Available water capacity is 11 to 13 inches. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. A seasonal high water table fluctuates between depths of 4 and 6 feet during winter and spring. This soil is subject to rare flooding.

This unit is used mainly for irrigated hay and pasture. It also is used for irrigated small grain, and it provides habitat for many kinds of wildlife.

Hay and pasture or cropland.—This unit is well suited to hay and pasture and to small grain. It has few limitations.

Management that maintains the optimum vigor and quality of forage plants is needed. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition. Periodic mowing and clipping help to maintain uniform growth and prevent selective grazing.

In summer irrigation is needed for the maximum production of most crops. Irrigation water can be applied by the controlled surface and sprinkler methods. The method used generally is governed by the crop. To avoid 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.

Fertilizer is needed to ensure the optimum growth of grasses, legumes, or small grain. Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain soil fertility and tilth.

Grazing during wet periods results in compaction to the surface layer and poor tilth. Compaction limits the movement of air and water in the soil and restricts the growth of roots.

The trees and shrubs grown as windbreaks and environmental plantings should be those that are tolerant of a high content of lime. The free carbonates in the soil tie up minerals and limit their availability. Cultivation or applications of herbicide help to remove competing vegetation.

The Jett soil is in the Loamy Bottom range site.

85D—Keating silt loam, 12 to 35 percent north slopes. This moderately deep, well drained soil is on hills. It formed in colluvium derived from greenstone and influenced by loess and volcanic ash in the surface layer. Areas are irregular in shape and are 40 to 200 acres in size. The vegetation is mainly bunchgrasses, forbs, and shrubs. Elevation is 3,000 to 3,800 feet. The average annual precipitation is 12 to 16 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 130 days.

Typically, the surface layer is very dark brown silt loam about 8 inches thick. The next layer is dark brown clay loam about 4 inches thick. The upper 5 inches of the subsoil is dark brown clay loam, and the lower 5 inches is dark yellowish brown clay. The depth to bedrock is 20 to 40 inches.

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

Permeability is moderate to a depth of about 17 inches in the Keating soil and slow below that depth. Available water capacity is 3 to 5 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 mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on this unit is dominated by Idaho fescue, squaw apple, and mountain big sagebrush.

Idaho fescue is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 2,200 pounds per acre in favorable years and 1,000 pounds per acre in unfavorable years.

If the condition of the site deteriorates through overgrazing, Idaho fescue loses vigor and decreases in extent. Mountain big sagebrush and bluebunch wheatgrass increase in extent. Bluegrasses invade. If deterioration continues, the extent of bluebunch wheatgrass decreases, the extent of mountain big sagebrush strongly increases, the extent of unpalatable forbs increases, and annuals invade the site.

The Keating soil is in the Mountain North 12-16pz range site.

86D—Kilmerque loam, 12 to 35 percent south slopes. This moderately deep, well drained soil is on mountains. It formed in colluvium derived from quartz diorite and related granitic rocks and influenced by volcanic ash in the surface layer. Areas are irregular in shape and are 80 to 600 acres in size. The native vegetation is mainly conifers, shrubs, bunchgrasses, and forbs. Elevation is 3,900 to 5,500 feet. The average annual precipitation is 17 to 30 inches, the average annual air temperature is 41 to 45 degrees F, and the average frost-free period is 80 to 100 days.

Typically, the surface is covered with a mat of partially decomposed needles, leaves, and twigs about 0.5 inch thick. The surface layer is very dark grayish brown loam about 5 inches thick. The upper part of the subsoil is dark brown loam about 7 inches thick. The lower part is dark yellowish brown sandy loam about 4 inches thick. The substratum is yellowish brown gravelly coarse sandy loam about 10 inches thick. The depth to weathered bedrock is 20 to 40 inches.

Included in this unit are small areas of Dogtown and Bouldrock soils. Also included are small areas of soils that are similar to the Kilmerque soil but are less than 20 inches deep over weathered bedrock. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate to a depth of about 16 inches in the Kilmerque soil and moderately rapid below that depth. Available water capacity is 2 to 5 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 mainly for timber production. It also is used for livestock grazing, and it provides habitat for many kinds of wildlife.

Woodland.—This unit is suited to the production of ponderosa pine and Douglas-fir. The mean site index is 82 for ponderosa pine (100-year base age) and 66 for Douglas-fir (50-year base age). The potential production at culmination of the mean annual increment for ponderosa pine is 72 cubic feet per acre per year (5.0 cubic meters per hectare per year) in a 40-year-old, even-aged, fully stocked stand and for Douglas-fir is 54 cubic feet per acre per year (3.8 cubic meters per hectare per year) in a 106-year-old, even-aged, fully stocked stand.

The main concerns in producing and harvesting timber are the hazard of erosion, the equipment limitation, seedling mortality, plant competition, the hazard of windthrow, and fire damage to the soil.

Minimizing the risk of erosion is essential in areas where timber is harvested. Properly designed road drainage systems that include carefully located culverts help to control erosion. Spoil from excavations is subject to rill and gully erosion and to sloughing. Roads, landings, skid trails, and firebreaks can be protected against erosion by constructing water bars and by seeding areas that have been cut and filled. Buffer strips may be needed in areas adjacent to perennial streams to minimize siltation and maintain stream temperatures.

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. The risk of compaction can be reduced by using low-pressure ground equipment, laying out skid trails in advance, and harvesting timber when the soil is dry or frozen. Compaction limits the movement of water and air in the soil and restricts the growth of roots. Cable yarding systems that partially or fully suspend logs generally do less damage to the soil than conventional ground-based systems.

Careful management of reforestation is needed to minimize competition from undesirable plants. If the site is not adequately prepared, plant competition can prevent or delay reestablishment of volunteer or planted trees. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying.

The seedling mortality rate is increased by compaction of the surface layer and by droughtiness in the surface layer, especially on south- and southwest-facing slopes. A low available water capacity generally limits seedling survival in areas where understory plants are numerous. Shading and mulching of seedlings may be required. The trees that are suitable for planting include ponderosa pine.

Trees commonly are subject to windthrow during periods when the soil is excessively wet and winds are strong. Regeneration systems that isolate single trees or groups of trees are not practical because of the hazard of windthrow.

Some decline in forest productivity may result from fire of moderate intensity.

Grazable woodland.—This unit is suitable for use as grazable woodland. The understory consists mainly of common snowberry, spirea, elk sedge, pinegrass, low Oregongrape, and strawberry. The potential production of the native understory plants in a normal year is about 800 pounds of air-dry forage per acre.

A system that results in proper grazing use is essential if livestock graze this unit. Timely deferment of grazing is needed to allow the desirable plants to mature and set seed. Grazing should be delayed in spring until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.

Seeding disturbed areas to suitable plants increases forage production. Deferred grazing is needed during periods when seedlings are becoming established.

This soil can produce adequate forage for big game animals after the tree canopy is opened by logging, fire, or some other disturbance. Dense stands of timber should be left in some areas to provide escape and thermal cover for the big game animals.

The Kilmerque soil is in the Pine-Fir-Sedge woodland understory site.

86E—Kilmerque loam, 35 to 50 percent south slopes. This moderately deep, well drained soil is on mountains. It formed in colluvium derived from quartz diorite and related granitic rocks and influenced by volcanic ash in the surface layer. Areas are irregular in shape and are 80 to 600 acres in size. The native vegetation is mainly conifers, shrubs, bunchgrasses, and forbs. Elevation is 3,900 to 5,500 feet. The average annual precipitation is 17 to 30 inches, the average annual air temperature is 41 to 45 degrees F, and the average frost-free period is 80 to 100 days.

Typically, the surface is covered with a mat of partially decomposed needles, leaves, and twigs about 0.5 inch thick. The surface layer is very dark grayish brown loam about 5 inches thick. The upper part of the subsoil is dark brown loam about 7 inches thick. The lower part is dark yellowish brown sandy loam about 4 inches thick. The substratum is yellowish brown gravelly coarse sandy loam about 10 inches thick. The depth to weathered bedrock is 20 to 40 inches.

Included in this unit are small areas of Bouldrock and Dogtown soils. Also included are small areas of soils that are similar to the Kilmerque soil but are less than 20 inches deep over weathered bedrock. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate to a depth of about 16 inches in the Kilmerque soil and moderately rapid below that depth. Available water capacity is 2 to 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 mainly for timber production. It also is used for livestock grazing, and it provides habitat for many kinds of wildlife.

Woodland.—This unit is suited to the production of ponderosa pine and Douglas-fir. The mean site index is 82 for ponderosa pine (100-year base age) and 66 for Douglas-fir (50-year base age). The potential production at culmination of the mean annual increment for ponderosa pine is 72 cubic feet per acre per year (5.0 cubic meters per hectare per year) in a 40-year-old, even-aged, fully stocked stand and for Douglas-fir is 54 cubic feet per acre per year (3.8 cubic meters per hectare per year) in a 106-year-old, even-aged, fully stocked stand.

The main concerns in producing and harvesting timber are the hazard of erosion, the equipment limitation, seedling mortality, plant competition, the hazard of windthrow, and fire damage to the soil.

Minimizing the risk of erosion is essential in areas where timber is harvested. Properly designed road drainage systems that include carefully located culverts help to control erosion. Spoil from excavations is subject to rill and gully erosion and to sloughing. Roads, landings, skid trails, and firebreaks can be protected against erosion by constructing water bars and by seeding areas that have been cut and filled. Buffer strips may be needed in areas adjacent to perennial streams to minimize siltation and maintain stream temperatures.

The slope restricts the use of wheeled and tracked equipment. High-lead or other logging systems that fully or partially suspend the logs above the ground cause less damage to the soil than tractor systems and reduce the risk of compaction. The risk of compaction also can be reduced by using low-pressure ground equipment, laying out skid trails in advance, and harvesting timber when the soil is dry or frozen.

Careful management of reforestation is needed to minimize competition from undesirable plants. If the site is not adequately prepared, plant competition can prevent or delay the reestablishment of volunteer or planted trees. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying. Scarification is severely restricted in the steeper areas because of increased expense and soil displacement.

The seedling mortality rate is increased by compaction of the surface layer because compaction limits the movement of water and air in the soil and restricts the growth of roots. Droughtiness in the surface layer also increases the seedling mortality rate, especially on south- and southwest-facing slopes. A low available water capacity generally limits seedling survival in areas where understory plants are numerous. Shading and mulching of seedlings may be required. The trees that are suitable for planting include ponderosa pine.

Trees commonly are subject to windthrow during periods when the soil is excessively wet and winds are strong. Regeneration systems that isolate single trees or groups of trees are not practical because of the hazard of windthrow.

Some decline in forest productivity may result from fire of moderate intensity.

Grazable woodland.—This unit is suitable for use as grazable woodland. The understory consists mainly of common snowberry, spirea, elk sedge, pinegrass, low Oregongrape, and strawberry. The potential production of the native understory plants in a normal year is about 800 pounds of air-dry forage per acre.

A system that results in proper grazing use is essential if livestock graze this unit. Timely deferment of grazing is needed to allow the desirable plants to mature and set seed. Grazing should be delayed in spring until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.

Seeding disturbed areas to suitable plants increases forage production. Deferred grazing is needed during periods when seedlings are becoming established.

This soil can produce adequate forage for big game animals after the tree canopy is opened by logging, fire, or some other disturbance. Dense stands of timber should be left in some areas to provide escape and thermal cover for the big game animals.

The Kilmerque soil is in the Pine-Fir-Sedge woodland understory site.

87D—Klicker stony silt loam, 12 to 35 percent south slopes. This moderately deep, well drained soil is on mountains. It formed in colluvium derived from basalt and andesite. Areas are irregular in shape and are 80 to 400 acres in size. The native vegetation is mainly conifers, shrubs, grasses, and forbs. Elevation is 3,600 to 6,000 feet. The average annual precipitation is 17 to 30 inches, the average annual air temperature is 40 to 45 degrees F, and the average annual frost-free period is 60 to 90 days.

Typically, the surface layer is covered with a mat of partially decomposed needles, leaves, and twigs about 1 inch thick. The surface layer is very dark brown stony silt loam about 5 inches thick. The next layer is dark brown very cobbly silt loam about 8 inches thick. The subsoil is dark reddish brown very cobbly silty clay loam. It extends to a depth of about 36 inches. The depth to bedrock is 20 to 40 inches.

Included in this unit are small areas of Anatone soils. Also included are small areas of soils that are similar to the Klicker soil but are more than 40 inches deep over bedrock. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate to a depth of about 13 inches in the Klicker soil and moderately slow below that depth. Available water capacity is 3 to 5 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 mainly for timber production. It also is used for livestock grazing, and it provides habitat for many kinds of wildlife.

Woodland.—This unit is suited to the production of ponderosa pine and Douglas-fir. The mean site index is 70 for ponderosa pine (100-year base age) and 60 for Douglas-fir (50-year base age). The potential production at culmination of the mean annual increment for ponderosa pine is 55 cubic feet per acre per year (3.8 cubic meters per hectare per year) in a 50-year-old, even-aged, fully stocked stand and for Douglas-fir is 44 cubic feet per acre per year (3.1 cubic meters per hectare per year) in a 110-year-old, even-aged, fully stocked stand.

The main concerns in producing and harvesting timber are the hazard of erosion, the equipment limitation, seedling mortality, plant competition, the hazard of windthrow, and fire damage to the soil.

Minimizing the risk of erosion is essential in areas where timber is harvested. Properly designed road drainage systems that include carefully located culverts help to control erosion. Spoil from excavations is subject to rill and gully erosion and to sloughing. Roads, landings, skid trails, and firebreaks can be protected against erosion by constructing water bars and by seeding areas that have been cut and filled. Buffer strips may be needed in areas adjacent to perennial streams to minimize siltation and maintain stream temperatures.

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. The risk of compaction can be reduced by using low-pressure ground equipment, laying out skid trails in advance, and harvesting timber when the soil is dry or frozen. Stones on the surface can interfere with felling, yarding, and other activities involving the use of equipment. Cable yarding systems that partially or fully suspend logs generally do less damage to the soil than conventional ground-based systems.

Careful management of reforestation is needed to minimize competition from undesirable plants. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying.

The seedling mortality rate is increased by compaction of the surface layer because compaction limits the movement of water and air in the soil and restricts the growth of roots. The high content of rock fragments also limits seedling survival. To compensate for the higher expected mortality rate, larger seedlings or a greater number of seedlings than is typical can be planted. Shading and mulching of seedlings may be required. The trees that are suitable for planting include ponderosa pine.

Trees are subject to windthrow because of the limited rooting depth and the high content of rock fragments. Regeneration systems that isolate single trees or groups of trees are not practical because of the hazard of windthrow.

Some decline in forest productivity may result from fire of moderate intensity.

Grazable woodland.—This unit is suitable for use as grazable woodland. The understory consists mainly of common snowberry, spirea, Idaho fescue, elk sedge, pinegrass, and strawberry. The potential production of the native understory plants in a normal year is about 800 pounds of air-dry forage per acre.

A system that results in proper grazing use is essential if livestock graze this unit. Timely deferment of grazing is needed to allow the desirable plants to mature and set seed. Grazing should be delayed in spring until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.

The suitability of the Klicker soil for seeding is fair. The main limitation is the surface stoniness. Seeding disturbed areas to suitable plants increases forage production. Deferred grazing is needed during periods when seedlings are becoming established.

This soil can produce adequate forage for big game animals after the tree canopy is opened by logging, fire, or some other disturbance. Stands of timber should be left in some areas to provide escape and thermal cover for the big game animals.

The Klicker soil is in the Pine-Snowberry-Sedge woodland understory site.

87E—Klicker stony silt loam, 35 to 60 percent south slopes. This moderately deep, well drained soil is on mountains. It formed in colluvium derived from basalt and andesite. Areas are irregular in shape and are 80 to 400 acres in size. The native vegetation is mainly conifers, shrubs, grasses, and forbs. Elevation is 3,600 to 6,000 feet. The average annual precipitation is 17 to 30 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 60 to 90 days.

Typically, the surface layer is covered with a mat of partially decomposed needles, leaves, and twigs about 1 inch thick. The surface layer is very dark brown stony silt loam about 5 inches thick. The next layer is dark brown very cobbly silt loam about 8 inches thick. The subsoil is dark reddish brown very cobbly silty clay loam. It extends to a depth of about 36 inches. The depth to bedrock is 20 to 40 inches.

Included in this unit are small areas of Anatone soils. Also included are small areas of soils that are similar to the Klicker soil but are more than 40 inches deep over bedrock. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate to a depth of about 13 inches in the Klicker soil and moderately slow below that depth. Available water capacity is 3 to 5 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high or very high.

This unit is used mainly for timber production. It also is used for livestock grazing, and it provides habitat for many kinds of wildlife.

Woodland.—This unit is suited to the production of ponderosa pine and Douglas-fir. The mean site index is 70 for ponderosa pine (100-year base age) and 60 for Douglas-fir (50-year base age). The potential production at culmination of the mean annual increment for ponderosa pine is 55 cubic feet per acre per year (3.8 cubic meters per hectare per year) in a 50-year-old, even-aged, fully stocked stand and for Douglas-fir is 44 cubic feet per acre per year (3.1 cubic meters per hectare per year) in a 110-year-old, even-aged, fully stocked stand.

The main concerns in producing and harvesting timber are the hazard of erosion, the equipment limitation, seedling mortality, plant competition, the hazard of windthrow, and fire damage to the soil.

Minimizing the risk of erosion is essential in areas where timber is harvested. Proper design to road drainage systems that include carefully located culverts help to control erosion. Spoil from excavations is subject to rill and gully erosion and to sloughing. Roads, landings, skid trails, and firebreaks can be protected against erosion by constructing water bars and by seeding areas that have been cut and filled. Buffer strips may be needed in areas adjacent to perennial streams to minimize siltation and maintain stream temperatures.

The slope restricts the use of wheeled and tracked equipment on skid trails. High-lead or other logging systems that fully or partially suspend the logs above the ground cause less damage to the soil than tractor systems and reduce the risk of compaction. The risk of compaction also can be reduced by using low-pressure ground equipment, laying out skid trails in advance, and harvesting timber when the soil is dry or frozen.

Careful management of reforestation is needed to minimize competition from undesirable plants. If the site is not adequately prepared, plant competition can prevent or delay the reestablishment of volunteer or planted trees. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying. Scarification is severely restricted in the steeper areas because of increased expense and soil displacement.

The seedling mortality rate is increased by compaction of the surface layer because compaction limits the movement of water and air in the soil and restricts the growth of roots. The high content of rock fragments also limits seedling survival. To compensate for the higher expected mortality rate, larger seedlings or a greater number of seedlings than is typical can be planted. Shading and mulching of seedlings may be required. The trees that are suitable for planting include ponderosa pine.

Trees are subject to windthrow because of the limited rooting depth and the high content of rock fragments in this soil. Regeneration systems that isolate single trees or groups of trees are not practical because of the hazard of windthrow.

Some decline in forest productivity may result from fire of moderate intensity.

Grazable woodland.—This unit is suitable for use as grazable woodland. The understory consists mainly of common snowberry, spirea, Idaho fescue, elk sedge, pinegrass, and strawberry. The potential production of the native understory plants in a normal year is about 800 pounds of air-dry forage per acre.

A system that results in proper grazing use is essential if livestock graze this unit. Timely deferment of grazing is needed to allow the desirable plants to mature and set seed. Grazing should be delayed in spring until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.

This soil can produce adequate forage for big game animals after the tree canopy is opened by logging, fire, or some other disturbance. Stands of timber should be left in some areas to provide escape and thermal cover for the big game animals.

The Klicker soil is in the Pine-Snowberry-Sedge woodland understory site.

88D—Klicker-Anatone complex, 12 to 35 percent south slopes. This map unit is on mountains. Areas are irregular in shape and are 40 to 200 acres in size. The native vegetation is mainly conifers on the Klicker soil and bunchgrasses, forbs, and shrubs on the Anatone soil. Elevation is 3,600 to 6,000 feet. The average annual precipitation is 17 to 30 inches, the average annual air temperature is 42 to 45 degrees F, and the average frost-free period is 60 to 90 days.

This unit is about 50 percent Klicker stony silt loam and 35 percent Anatone extremely stony loam. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of soils that are similar to the Anatone soil but are less than 10 inches deep over bedrock. Also included are small areas of soils that are similar to the Klicker soil but are more than 40 inches deep over bedrock and small areas of Rock outcrop. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Klicker soil is moderately deep and well drained. It formed in colluvium derived from andesite and basalt. Typically, the surface is covered with a mat of partially decomposed needles, leaves, and twigs about 1 inch thick. The surface layer is very dark brown stony silt loam about 5 inches thick. The next layer is dark brown very cobbly silt loam about 8 inches thick. The subsoil is dark reddish brown very cobbly silty clay loam. It extends to a depth of about 36 inches. The depth to bedrock is 20 to 40 inches.

Permeability is moderate to a depth of about 13 inches in the Klicker soil and moderately slow below that depth. Available water capacity is 3 to 5 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate or high.

The Anatone soil is shallow and well drained. It formed in colluvium derived from andesite and basalt. Typically, the surface layer is black extremely stony loam about 8 inches thick. The subsoil is very dark brown extremely cobbly loam about 8 inches thick. The depth to bedrock is 10 to 20 inches.

Permeability is moderate in the Anatone soil. Available water capacity is 1 to 2 inches. The effective rooting depth is 10 to 20 inches. Runoff is medium, and the hazard of water erosion is moderate or high.

This unit is used mainly for timber production. It also is used for livestock grazing, and it provides habitat for many kinds of wildlife.

Woodland.—The Klicker soil is suited to the production of ponderosa pine and Douglas-fir. The mean site index is 70 for ponderosa pine (100-year base age) and 60 for Douglas-fir (50-year base age). The potential production at culmination of the mean annual increment for ponderosa pine is 55 cubic feet per acre per year (3.8 cubic meters per hectare per year) in a 50-year-old, even-aged, fully stocked stand and for Douglas-fir is 44 cubic feet per acre per year (3.1 cubic meters per hectare per year) in a 110-year-old, even-aged, fully stocked stand.

The main concerns in producing and harvesting timber are the hazard of erosion, the equipment limitation, seedling mortality, plant competition, the hazard of windthrow, and fire damage to the soil.

Minimizing the risk of erosion is essential in areas where timber is harvested. Properly designed road drainage systems that include carefully located culverts help to control erosion. Spoil from excavations is subject to rill and gully erosion and to sloughing. Roads, landings, skid trails, and firebreaks can be protected against erosion by constructing water bars and by seeding areas that have been cut and filled. Buffer strips may be needed in areas adjacent to perennial streams to minimize siltation and maintain stream temperatures.

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. The risk of compaction can be reduced by using low-pressure ground equipment, laying out skid trails in advance, and harvesting timber when the soil is dry or frozen. Stones on the surface can interfere with felling, yarding, and other activities involving the use of equipment. Cable yarding systems that partially or fully suspend logs generally do less damage to the soil than conventional ground-based systems.

Careful management of reforestation is needed to minimize competition from undesirable plants. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying.

The seedling mortality rate is increased by compaction of the surface layer because compaction limits the movement of water and air in the soil and restricts the growth of roots. The high content of rock fragments also limits seedling survival. To compensate for the higher expected mortality rate, larger seedlings or a greater number of seedlings than is typical can be planted. Shading and mulching of seedlings may be required. The trees that are suitable for planting include ponderosa pine.

Trees are subject to windthrow because of the limited rooting depth and the high content of rock fragments. Regeneration systems that isolate single trees or groups of trees are not practical because of the hazard of windthrow.

Some decline in forest productivity may result from fire of moderate intensity.

Grazable woodland.—The Klicker soil is suitable for use as grazable woodland. The understory consists mainly of common snowberry, spirea, Idaho fescue, elk sedge, pinegrass, and strawberry. The potential production of the native understory plants in a normal year is about 800 pounds of air-dry forage per acre.

A system that results in proper grazing use is essential if livestock graze this unit. Timely deferment of grazing is needed to allow the desirable plants to mature and set seed. Grazing should be delayed in spring until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.

The suitability of the Klicker soil for seeding is fair. The main limitation is the surface stoniness. Seeding disturbed areas to suitable plants increases forage production. Deferred grazing is needed during periods when seedlings are becoming established.

This soil can produce adequate forage for big game animals after the tree canopy is opened by logging, fire, or some other disturbance. Stands of timber should be left in some areas to provide escape and thermal cover for the big game animals.

Livestock grazing.—The potential plant community on the Anatone soil is dominated by bluebunch wheatgrass, Sandberg bluegrass, Idaho fescue, mountain big sagebrush, squaw apple, and antelope bitterbrush.

Bluebunch wheatgrass is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 1,100 pounds per acre in favorable years and 500 pounds per acre in unfavorable years. Livestock access is limited by the stones on the surface.

If the condition of the site deteriorates through overgrazing, bluebunch wheatgrass loses vigor and decreases in extent. Sandberg bluegrass, mountain big sagebrush, and squaw apple increase in extent. If deterioration continues, the extent of Idaho fescue decreases and the extent of mountain big sagebrush, Sandberg bluegrass, and squaw apple strongly increases.

Mechanical treatment for brush control and range seeding is not practical because of the stones on the surface.

The Klicker soil is in the Pine-Snowberry-Sedge woodland understory site. The Anatone soil is in the Mountain Shallow South 16-20pz range site.

89D—Klicker-Fivebit complex, 12 to 35 percent south slopes. This map unit is on mountains. Areas are irregular in shape and are 100 to 400 acres in size. The native vegetation is mainly conifers, shrubs, and grasses. Elevation is 4,400 to 5,800 feet. The average annual precipitation is 17 to 30 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 60 to 90 days.

This unit is about 60 percent Klicker stony silt loam and 25 percent Fivebit extremely stony loam. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of Hall Ranch soils and Rock outcrop. Also included are small areas of soils that are similar to the Fivebit soil but are less than 10 inches deep over bedrock. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Klicker soil is moderately deep and well drained. It formed in colluvium derived from andesite and basalt. Typically, the surface layer is very dark brown stony silt loam about 5 inches thick. The next layer is dark brown very cobbly silt loam about 8 inches thick. The subsoil is dark reddish brown very cobbly silty clay loam. It extends to a depth of about 36 inches. The depth to bedrock is 20 to 40 inches.

Permeability is moderate to a depth of about 13 inches in the Klicker soil and moderately slow below that depth. Available water capacity is 3 to 5 inches. The effective rooting depth is 20 to 40 inches. Runoff is

medium, and the hazard of water erosion is moderate or high.

The Fivebit soil is shallow and well drained. It formed in colluvium derived from andesite and basalt. Typically, the surface is covered with a mat of partially decomposed needles, leaves, and twigs about 0.5 inch thick. The surface layer is very dark grayish brown extremely stony loam about 3 inches thick. The next layer is very dark grayish brown very gravelly loam about 9 inches thick. The subsoil is dark brown extremely gravelly clay loam about 6 inches thick. The depth to bedrock is 10 to 20 inches.

Permeability is moderately slow in the Fivebit soil. Available water capacity is 1 to 3 inches. The effective rooting depth is 10 to 20 inches. Runoff is medium, and the hazard of water erosion is moderate or high.

This unit is used mainly for timber production. It also is used for livestock grazing, and it provides habitat for many kinds of wildlife.

Woodland.—The Klicker soil is suited to the production of ponderosa pine and Douglas-fir. The mean site index is 70 for ponderosa pine (100-year base age) and 60 for Douglas-fir (50-year base age). The potential production at culmination of the mean annual increment for ponderosa pine is 55 cubic feet per acre per year (3.8 cubic meters per hectare per year) in a 50-year-old, even-aged, fully stocked stand and for Douglas-fir is 44 cubic feet per acre per year (3.1 cubic meters per hectare per year) in a 110-year-old, even-aged, fully stocked stand.

The main concerns in producing and harvesting timber are the hazard of erosion, the equipment limitation, seedling mortality, plant competition, the hazard of windthrow, and fire damage to the soil.

Minimizing the risk of erosion is essential in areas where timber is harvested. Properly designed road drainage systems that include carefully located culverts help to control erosion. Spoil from excavations is subject to rill and gully erosion and to sloughing. Roads, landings, skid trails, and firebreaks can be protected against erosion by constructing water bars and by seeding areas that have been cut and filled. Buffer strips may be needed in areas adjacent to perennial streams to minimize siltation and maintain stream temperatures.

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. The risk of compaction can be reduced by using low-pressure ground equipment, laying out skid trails in advance, and harvesting timber when the soil is dry or frozen. Stones on the surface can interfere with felling, yarding, and other activities involving the use of equipment. Cable yarding systems that partially or fully suspend logs generally do less damage to the soil than conventional ground-based systems.

Careful management of reforestation is needed to minimize competition from undesirable plants. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying.

The seedling mortality rate is increased by compaction of the surface layer because compaction limits the movement of water and air in the soil and restricts the growth of roots. The high content of rock fragments also limits seedling survival. To compensate for the higher expected mortality rate, larger seedlings or a greater number of seedlings than is typical can be planted. Shading and mulching of seedlings may be required. The trees that are suitable for planting include ponderosa pine and Douglas-fir.

Trees are subject to windthrow because of the limited rooting depth and the high content of rock fragments in the soil. Regeneration systems that isolate single trees or groups of trees are not practical because of the hazard of windthrow.

Some decline in forest productivity may result from fire of moderate intensity.

Grazable woodland.—The Klicker soil is suitable for use as grazable woodland. The understory consists mainly of common snowberry, spirea, Idaho fescue, elk sedge, pinegrass, and strawberry. The potential production of the native understory plants in a normal year is about 800 pounds of air-dry forage per acre.

A system that results in proper grazing use is essential if livestock graze this unit. Timely deferment of grazing is needed to allow the desirable plants to mature and set seed. Grazing should be delayed in spring until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.

The suitability of the Klicker soil for seeding is fair. The main limitation is the surface stoniness. Seeding disturbed areas to suitable plants increases forage production.

This soil can produce adequate forage for big game animals after the tree canopy is opened by logging, fire, or some other disturbance. Stands of timber should be left in some areas to provide escape and thermal cover for the big game animals.

Livestock grazing.—The potential plant community on the Fivebit soil is dominated by curlleaf mountainmahogany, bluebunch wheatgrass, western juniper, and bitterbrush.

Bluebunch wheatgrass is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 1,300 pounds per acre in favorable years and 600 pounds per acre in unfavorable years. Livestock access is limited by the

Rock outcrop and the rock fragments on the surface.

If the condition of the site deteriorates through overgrazing, bluebunch wheatgrass loses vigor and decreases in extent. Curlleaf mountainmahogany, western juniper, and bitterbrush increase in extent. If deterioration continues, shrubs, forbs, and annual grasses invade the site.

Mechanical treatment for brush control and range seeding is not practical because of the stones on the surface.

The Klicker soil is in the Pine-Snowberry-Sedge woodland understory site. The Fivebit soil is in the Mahogany Rockland 12+pz range site.

89E—Klicker-Fivebit complex, 35 to 60 percent south slopes. This map unit is on mountains. Areas are irregular in shape and are 100 to 400 acres in size. The native vegetation is mainly conifers, shrubs, and grasses. Elevation is 4,400 to 5,800 feet. The average annual precipitation is 17 to 30 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 60 to 90 days.

This unit is about 50 percent Klicker stony silt loam and 35 percent Fivebit extremely stony loam. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of Hall Ranch soils and Rock outcrop. Also included are small areas of soils that are similar to the Fivebit soil but are less than 10 inches deep over bedrock. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Klicker soil is moderately deep and well drained. It formed in colluvium derived from andesite and basalt. Typically, the surface layer is very dark brown stony silt loam about 5 inches thick. The next layer is dark brown very cobbly silt loam about 8 inches thick. The subsoil is dark reddish brown very cobbly silty clay loam. It extends to a depth of about 36 inches. The depth to bedrock is 20 to 40 inches.

Permeability is moderate to a depth of about 13 inches in the Klicker soil and moderately slow below that depth. Available water capacity is 3 to 5 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

The Fivebit soil is shallow and well drained. It formed in colluvium derived from andesite and basalt. Typically, the surface is covered with a mat of partially decomposed needles, leaves, and twigs about 0.5 inch thick. The surface layer is very dark grayish brown extremely stony loam about 3 inches thick. The next layer is very dark grayish brown very gravelly loam about 9 inches thick. The subsoil is dark brown extremely gravelly clay loam about 6 inches thick. The depth to bedrock is 10 to 20 inches.

Permeability is moderately slow in the Fivebit soil. Available water capacity is 1 to 3 inches. The effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used mainly for timber production. It also is used for livestock grazing, and it provides habitat for many kinds of wildlife.

Woodland.—The Klicker soil is suited to the production of ponderosa pine and Douglas-fir. The mean site index is 70 for ponderosa pine (100-year base age) and 60 for Douglas-fir (50-year base age). The potential production at culmination of the mean annual increment for ponderosa pine is 55 cubic feet per acre per year (3.8 cubic meters per hectare per year) in a 50-year-old, even-aged, fully stocked stand and for Douglas-fir is 44 cubic feet per acre per year (3.1 cubic meters per hectare per year) in a 110-year-old, even-aged, fully stocked stand.

The main concerns in producing and harvesting timber are the hazard of erosion, the equipment limitation, seedling mortality, plant competition, the hazard of windthrow, and fire damage to the soil.

Minimizing the risk of erosion is essential in areas where timber is harvested. Properly designed road drainage systems that include carefully located culverts help to control erosion. Spoil from excavations is subject to rill and gully erosion and to sloughing. Roads, landings, skid trails, and firebreaks can be protected against erosion by constructing water bars and by seeding areas that have been cut and filled. Buffer strips may be needed in areas adjacent to perennial streams to minimize siltation and maintain stream temperatures.

The slope restricts the use of wheeled and tracked equipment on skid trails. High-lead or other logging systems that fully or partially suspend the logs above the ground cause less damage to the soil than tractor systems and reduce the risk of compaction. The risk of compaction also can be reduced by using low-pressure ground equipment, laying out skid trails in advance, and harvesting timber when the soil is dry or frozen.

Careful management of reforestation is needed to minimize competition from undesirable plants. If the site is not adequately prepared, plant competition can prevent or delay the reestablishment of volunteer or planted trees. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying. Scarification is severely restricted in the steeper areas because of increased expense and soil displacement.

The seedling mortality rate is increased by compaction of the surface layer because compaction limits the movement of water and air in the soil and restricts the growth of roots. The high content of rock fragments also limits seedling survival. To compensate for the higher expected mortality rate, larger seedlings or a greater number of seedlings than is typical can be planted. Shading and mulching of seedlings may be required. The trees that are suitable for planting include ponderosa pine and Douglas-fir.

Trees are subject to windthrow because of the limited rooting depth and the high content of rock fragments in the soil. Regeneration systems that isolate single trees or groups of trees are not practical because of the hazard of windthrow.

Some decline in forest productivity may result from fire of moderate intensity.

Grazable woodland.—This unit is suitable for use as grazable woodland. The understory consists mainly of common snowberry, spirea, Idaho fescue, elk sedge, pinegrass, and strawberry. The potential production of the native understory plants in a normal year is about 800 pounds of air-dry forage per acre.

A system that results in proper grazing use is essential if livestock graze this unit. Deferment of grazing every other year allows the desirable plants to mature and set seed. Deferred grazing is needed during periods when seedlings are becoming established. Grazing should be delayed in spring until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.

This soil can produce adequate forage for big game animals after the tree canopy is opened by logging, fire, or some other disturbance. Stands of timber should be left in some areas to provide escape and thermal cover for the big game animals.

Livestock grazing.—The potential plant community on the Fivebit soil is dominated by curlleaf mountainmahogany, bluebunch wheatgrass, western juniper, and bitterbrush.

Bluebunch wheatgrass is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 1,300 pounds per acre in favorable years and 600 pounds per acre in unfavorable years. Livestock access is limited by the Rock outcrop, the slope, and the stones on the surface.

If the condition of the site deteriorates through overgrazing, bluebunch wheatgrass loses vigor and decreases in extent. Curlleaf mountainmahogany, western juniper, and bitterbrush increase in extent. If deterioration continues, shrubs, forbs, and grasses invade the site.

Mechanical treatment for brush control and range seeding is not practical because of the slope and the stones on the surface.

The Klicker soil is in the Pine-Snowberry-Sedge woodland understory site. The Fivebit soil is in the Mahogany Rockland 12+pz range site.

90B—Ladd loam, 2 to 7 percent slopes. This deep, well drained soil is on foot slopes and fans. It formed in alluvium and colluvium of mixed origin. Areas are irregular in shape and are 40 to 200 acres in size. The vegetation in areas that have not been cultivated is mainly grasses and shrubs. Elevation is 3,400 to 4,000 feet. The average annual precipitation is 12 to 16 inches, the average annual air temperature is 45 to 48 degrees F, and the average frost-free period is 100 to 120 days.

Typically, the surface layer is very dark brown loam about 16 inches thick. The subsoil is brown clay loam about 16 inches thick. The substratum to a depth of 60 inches or more is brown loam and clay loam.

Included in this unit are small areas of Hibbard and Goodrich soils. Also included are small areas of soils that are similar to the Ladd soil but are less than 60 inches deep over bedrock. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderately slow in the Ladd soil. Available water capacity is 8 to 12 inches. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight or moderate.

Most areas of this unit are used for irrigated hay and pasture (fig. 7) or small grain. A few areas are used for homesite development.

Hay and pasture.—This unit is well suited to hay and pasture. It has few limitations.

Management that maintains the optimum vigor and quality of forage plants is needed. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and control erosion. Periodic mowing and clipping help to maintain uniform growth and prevent selective grazing.

In summer irrigation is needed for the maximum production of most crops. Irrigation water can be applied by the controlled surface and sprinkler methods. Sprinkler irrigation permits the even, controlled application of water, helps to control runoff, and minimizes the risk of erosion. To avoid 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.

Fertilizer is needed to ensure the optimum growth of grasses and legumes. 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.

Conducting fieldwork during wet periods results in

Figure 7.—Alfala hay on Ladd loam, 2 to 7 percent slopes. In the background: Dogtown very stony loam, 55 to 80 percent north slopes.

deterioration of tilth and destroys soil structure. As a result, it increases the runoff rate and the hazard of erosion. Runoff and erosion can be controlled by managing residue and using rough or minimum tillage. All tillage should be on the contour or across the slope.

Grazing during wet periods results in compaction of the surface layer, poor tilth, and excessive runoff. Compaction limits the movement of air and water in the soil and restricts the growth of roots.

A wide variety of trees and shrubs can be grown as windbreaks and environmental plantings on this soil. Cultivation or applications of herbicide help to remove competing vegetation.

Homesite development.—If this unit is used for homesite development, the main limitations are the shrink-swell potential, a moderate potential for frost action, low strength, the moderately slow permeability, and the slope.

On sites for septic tank absorption fields, the moderately slow permeability can be overcome by increasing the size of the absorption fields. Properly designing the foundations and footings of buildings and diverting runoff away from the buildings help to prevent the structural damage caused by shrinking and swelling. The risk of settlement can be minimized by compacting the site before construction. Roads built on this unit require large amounts of base rock to prevent settling. Properly designing the roads helps to offset the moderate potential for frost action and the shrink-swell potential. In the steeper areas the hazard of erosion can be reduced by disturbing only the part of the site that is used for construction.

The Ladd soil is in the Mountain Clayey 12-16pz range site.

90C—Ladd loam, 7 to 12 percent slopes. This deep, well drained soil is on foot slopes and fans. It formed in alluvium and colluvium of mixed origin. Areas are irregular in shape and are 40 to 200 acres in size. The vegetation in areas that have not been cultivated is mainly grasses and shrubs. Elevation is 3,400 to 4,000 feet. The average annual precipitation is 12 to 16 inches, the average annual air temperature is 45 to 48 degrees F, and the average frost-free period is 100 to 120 days.

Typically, the surface layer is very dark brown loam about 16 inches thick. The subsoil is brown clay loam about 16 inches thick. The substratum to a depth of 60 inches or more is brown loam and clay loam.

Included in this unit are small areas of Hibbard and Goodrich soils. Also included are small areas of soils that are similar to the Ladd soil but are less than 60 inches deep over bedrock. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderately slow in the Ladd soil. Available water capacity is 8 to 12 inches. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

Most areas of this unit are used for irrigated hay and pasture. A few areas are used for small grain or homesite development.

Hay and pasture.—This unit is well suited to hay and pasture. It has few limitations.

Management that maintains the optimum vigor and quality of forage plants is needed. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and control erosion. Periodic mowing and clipping help to maintain uniform growth and prevent selective grazing.

In summer irrigation is needed for the maximum production of most crops. Sprinkler irrigation is a suitable method of applying water. It permits the even, controlled application of water, helps to control runoff, and minimizes the risk of erosion. To avoid 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.

Fertilizer is needed to ensure the optimum growth of grasses and legumes. 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.

Conducting fieldwork during wet periods reduces tilth and destroys soil structure. As a result, it increases the runoff rate and the hazard of erosion. Runoff and erosion can be controlled by managing residue and using rough or minimum tillage. All tillage should be on the contour or across the slope.

Grazing during wet periods results in compaction of the surface layer, poor tilth, and excessive runoff. Compaction limits the movement of air and water in the soil and restricts the growth of roots.

A wide variety of trees and shrubs can be grown as windbreaks and environmental plantings on this soil. Cultivation or applications of herbicide help to remove competing vegetation.

Homesite development.—If this unit is used for homesite development, the main limitations are the slope, the shrink-swell potential, a moderate potential for frost action, low strength, and the moderately slow permeability.

On sites for septic tank absorption fields, the moderately slow permeability can be overcome by increasing the size of the absorption fields. The slope can hinder installation of the absorption fields. The absorption lines should be installed on the contour.

Properly designing the foundations and footings of buildings and diverting runoff away from the buildings help to prevent the structural damage caused by shrinking and swelling. The risk of settlement can be minimized by compacting the site before construction.

Roads built on this unit require large amounts of base rock to prevent settling. Properly designing the roads helps to offset the moderate potential for frost action and the shrink-swell potential.

Erosion is a hazard in the steeper areas. Only the part of the site that is used for construction should be disturbed.

The Ladd soil in in the Mountain Clayey 12-16pz range site.

91A—La Grande silt loam, 0 to 3 percent slopes. This deep, well drained soil is on flood plains and low stream terraces. It formed in mixed alluvium high in volcanic ash. Areas are elongated and are 20 to 100 acres in size. The vegetation in areas that have not been cultivated is mainly bunchgrasses and forbs. Elevation is 2,400 to 3,200 feet. The average annual precipitation is 18 to 22 inches, the average annual air temperature is 46 to 49 degrees F, and the average frost-free period is 110 to 130 days.

Typically, the surface layer is black silt loam about 39 inches thick. The substratum to a depth of 60 inches or more is dark brown and dark yellowish brown very fine sandy loam.

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

Permeability is moderate in the La Grande soil. Available water capacity is 10 to 12 inches. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. A seasonal high water table fluctuates between depths of 5 and 6 feet in spring. This soil is subject to rare flooding.

This unit is used mainly for irrigated hay and pasture or small grain. It also provides habitat for many kinds of wildlife.

Hay and pasture or cropland.—This unit is well suited to hay and pasture and to small grain. It has few limitations.

Management that maintains the optimum vigor and quality of forage plants is needed. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and control erosion. Periodic mowing and clipping help to maintain uniform growth and prevent selective grazing.

Fertilizer is needed to ensure the optimum growth of grasses and legumes. Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain soil fertility and tilth.

In summer irrigation is needed for the maximum production of most crops. Irrigation water can be applied by the controlled surface and sprinkler methods. The method used generally is governed by the crop. To avoid 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.

Grazing during wet periods results in compaction of the surface layer and poor tilth. Compaction limits the movement of air and water in the soil and restricts the growth of roots.

The trees and shrubs grown as windbreaks and environmental plantings should be those that are tolerant of a high content of lime. The free carbonates in the soil tie up minerals and limit their availability. Cultivation or applications of herbicide help to remove competing vegetation.

The La Grande soil is in the Meadow range site.

92A—Langrell gravelly loam, 0 to 3 percent slopes. This deep, well drained soil is on outwash terraces. It formed in mixed glaciofluvial deposits. Areas are irregular in shape and are 40 to 100 acres in size. The native vegetation is mainly bunchgrasses and shrubs and a few scattered ponderosa pines. Elevation is 2,500 to 3,400 feet. The average annual precipitation is 18 to 22 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 110 to 130 days.

Typically, the surface layer is very dark grayish brown gravelly loam about 7 inches thick. The upper 13 inches of the subsoil is dark brown gravelly loam. The lower 14 inches is dark brown extremely cobbly loam. The substratum to a depth of 60 inches or more is dark brown very stony sandy loam.

Included in this unit are small areas of Catherine, Hershal, and La Grande soils and Cumulic Haploxerolls. Also included are small areas of Langrell very cobbly loam. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate to a depth of about 34 inches in the Langrell soil and moderately rapid below that depth. Available water capacity is 3 to 6 inches. The effective rooting depth is limited by a very stony substratum at a depth of 20 to 40 inches. Runoff is slow, and the hazard of water erosion is slight. This soil is subject to rare flooding.

This unit is used mainly for irrigated hay and pasture. It also is used for homesite development, and it provides habitat for many kinds of wildlife.

Hay and pasture.—If this unit is used for hay and pasture, the main limitation is a low available water capacity in the Langrell soil.

Management that maintains the optimum vigor and quality of forage plants is needed. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and control erosion. Periodic mowing and clipping help to maintain uniform growth and prevent selective grazing.

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

Fertilizer is needed to ensure the optimum growth of grasses and legumes. Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain soil fertility and tilth.

The high content of cobbles and stones reduces the amount of moisture available to plants. In summer irrigation is needed for the maximum production of most crops. Irrigation water can be applied by the controlled surface and sprinkler methods. The method used generally is governed by the crop. To avoid 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.

Conducting fieldwork during wet periods results in deterioration of tilth and destroys soil structure. As a result, it increases the runoff rate and the hazard of erosion. Compaction limits the movement of air and water in the soil and restricts the growth of roots.

The trees and shrubs grown as windbreaks and environmental plantings should be those that are tolerant of droughty conditions. A low available water capacity causes moderate seedling mortality. Continued cultivation, mulching, or applications of herbicide to control competing vegetation are needed to ensure the establishment and survival of seedlings. Irrigation may be needed when the trees and shrubs are planted and during dry periods.

Homesite development.—If this unit is used for homesite development, the main management concerns are the hazard of flooding and a moderate potential for frost action.

Septic tank absorption fields do not function properly during periods of flooding. Dikes and channels that have outlets for floodwater can protect buildings and onsite sewage disposal systems from flooding. Roads and streets should be built above the expected level of flooding. Properly designing the roads and streets helps to offset the moderate potential for frost action.

The Langrell soil is in the Loamy 17-22pz range site.

93A—Langrell very cobbly loam, 0 to 3 percent slopes. This deep, well drained soil is on outwash terraces. It formed in glaciofluvial deposits. Areas are irregular in shape and are 40 to 100 acres in size. The native vegetation is mainly bunchgrasses and shrubs and scattered ponderosa pine. Elevation is 2,500 to 3,400 feet. The average annual precipitation is 18 to 22 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 110 to 130 days.

Typically, the surface layer is very dark grayish brown very cobbly loam about 7 inches thick. The upper 13 inches of the subsoil is dark brown gravelly loam. The lower 14 inches is dark brown extremely cobbly loam. The substratum to a depth of 60 inches or more is dark brown very stony sandy loam.

Included in this unit are small areas of Hershal, Catherine, and La Grande soils. Also included are small areas of Cumulic Haploxerolls and Langrell gravelly loam. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate to a depth of about 34 inches in the Langrell soil and moderately rapid below that depth. Available water capacity is 3 to 5 inches. The effective rooting depth is limited by a very stony substratum at a depth of 20 to 40 inches. Runoff is slow, and the hazard of water erosion is slight. This soil is subject to rare flooding.

This unit is used mainly for irrigated pasture. It also provides habitat for many kinds of wildlife.

Hay and pasture.—If this unit is used for hay and pasture, the main limitations are the cobbles on the surface and a low available water capacity.

Management that maintains the optimum vigor and quality of forage plants is needed. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and control erosion. Periodic mowing and clipping help to maintain uniform growth and prevent selective grazing. The large number of cobbles on the surface limits some fieldwork.

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

Fertilizer is needed to ensure the optimum growth of grasses and legumes.

The high content of cobbles and stones reduces the amount of moisture available to plants. In summer irrigation is needed for the maximum production of hay and pasture. Controlled surface irrigation is best suited to this unit. To avoid 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.

Grazing during wet periods results in compaction of the surface layer and poor tilth. Compaction limits the movement of air and water in the soil and restricts the growth of roots.

The trees and shrubs grown as windbreaks and environmental plantings should be those that are tolerant of droughty conditions. A low available water capacity causes moderate seedling mortality. Continued cultivation, mulching, or applications of herbicide to control competing vegetation are needed to ensure the establishment and survival of seedlings. Irrigation may be needed when the trees and shrubs are planted and during dry periods.

The Langrell soil is in the Loamy 17-22pz range site.

94C—Legler silt loam, 2 to 8 percent slopes. This deep, well drained soil is on incised flood plains and fans. It formed in mixed alluvium influenced by volcanic ash and loess in the surface layer (fig. 8). Areas are long and rectangular and are 100 to 800 acres in size. The native vegetation is mainly bunchgrasses, forbs, and shrubs. Elevation is 2,800 to 3,600 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 110 to 130 days.

Typically, the surface layer is very dark grayish brown and dark brown silt loam about 9 inches thick. The next 10 inches is dark brown loam. Below this to a depth of about 60 inches is dark brown and brown silt loam.

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

Permeability is moderate in the Legler soil. Available water capacity is 8 to 13 inches. The effective rooting

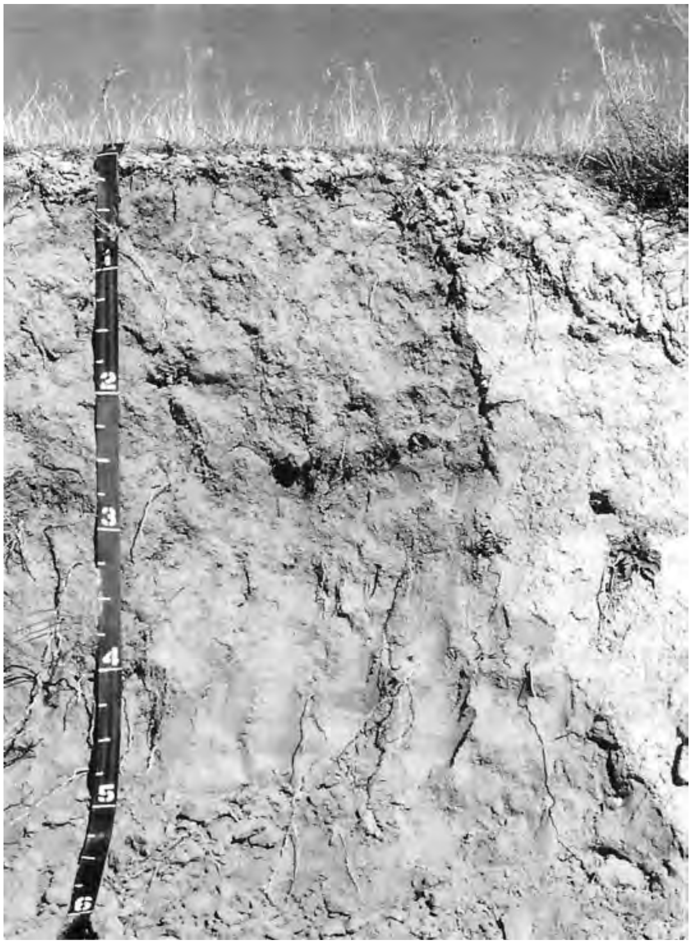

Figure 8.—Typical profile of Legler silt loam, 2 to 8 percent slopes.

depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight or moderate. This soil is subject to rare flooding.

This unit is used mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on this unit is dominated by basin wildrye and basin big sagebrush.

Basin wildrye is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 6,000 pounds per acre in favorable years and 2,000 pounds per acre in unfavorable years.

If the condition of the site deteriorates through overgrazing, basin wildrye loses vigor and decreases in extent. Basin big sagebrush increases in extent. If deterioration continues, annual plants strongly invade the site.

The Legler soil is in the Loamy Bottom range site.

95C—Legler gravelly loam, 8 to 20 percent slopes. This deep, well drained soil is on terraces and fans. It formed in mixed alluvium influenced by loess and volcanic ash in the surface layer. Areas are elongated and are 80 to 400 acres in size. The native vegetation is mainly bunchgrasses, forbs, and shrubs. Elevation is 2,700 to 4,000 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 110 to 130 days.

Typically, the surface layer is dark brown gravelly loam about 7 inches thick. The next layer is brown loam about 3 inches thick. The upper 29 inches of the subsoil is brown silt loam. The lower part to a depth of about 60 inches is dark yellowish brown silt loam.

Included in this unit are small areas of Virtue and Hyall soils. Also included are small areas of Legler soils that have a surface layer of silt loam. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate in the Legler soil. Available water capacity is 8 to 13 inches. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. This soil is subject to rare flooding.

This unit is used mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on this unit is dominated by Idaho fescue, needleandthread, and Wyoming big sagebrush.

Idaho fescue and Thurber needlegrass are the major forage-producing plants. If the site is in excellent condition, the total annual production is estimated at 1,500 pounds per acre in favorable years and 500 pounds per acre in unfavorable years.

If the condition of the site deteriorates through overgrazing, Idaho fescue loses vigor and decreases in extent. Needleandthread, Thurber needlegrass, Sandberg bluegrass, and Wyoming big sagebrush increase in extent. If overgrazing continues, the extent of needlegrass decreases and cheatgrass and other annual grasses and forbs invade the site.

The Legler soil is in the Mountain Loamy 9-12pz range site.

96E—Lickskillet very gravelly sandy loam, 30 to 50 percent south slopes. This shallow, well drained soil is on hills. It formed in colluvium derived from metaandesite. Areas are irregular in shape and are 100 to 400 acres in size. The native vegetation is mainly bunchgrasses and forbs. Elevation is 2,000 to 3,600 feet. The average annual precipitation is 10 to 12 inches, the average annual air temperature is 47 to 50

degrees F, and the average frost-free period is 110 to 150 days.

Typically, the surface layer is very dark grayish brown very gravelly sandy loam about 6 inches thick. The upper 4 inches of the subsoil is dark brown very gravelly clay loam. The lower 8 inches is brown very cobbly clay loam. The depth to fractured bedrock is 10 to 20 inches.

Included in this unit are small areas of Redcliff and Ruckles soils. Also included are small areas of soils that are similar to the Lickskillet soil but are less than 10 inches deep over bedrock and small areas of Rock outcrop. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate in the Lickskillet soil. Available water capacity is 1 to 2 inches. The effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on this unit is dominated by bluebunch wheatgrass and lomatium.

Bluebunch wheatgrass is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 800 pounds per acre in favorable years and 300 pounds per acre in unfavorable years. Livestock access is limited by the rock fragments on the surface and the slope.

If the condition of the site deteriorates through overgrazing, bluebunch wheatgrass loses vigor and decreases in extent. Sandberg bluegrass and lomatium increase in extent. If deterioration continues, cheatgrass and other annual plants invade the site.

Mechanical treatment for brush control and range seeding is not practical because of the slope.

The Lickskillet soil is in the Shallow South 9-12pz range site.

96F—Lickskillet very gravelly sandy loam, 50 to 70 percent south slopes. This shallow, well drained soil is on hills. It formed in colluvium derived from metaandesite. Areas are irregular in shape and are 100 to 400 acres in size. The native vegetation is mainly bunchgrasses and forbs. Elevation is 2,000 to 3,600 feet. The average annual precipitation is 10 to 12 inches, the average annual air temperature is 47 to 50 degrees F, and the average frost-free period is 110 to 150 days.

Typically, the surface layer is very dark grayish brown very gravelly sandy loam about 6 inches thick. The upper 4 inches of the subsoil is dark brown very gravelly clay loam. The lower 8 inches is brown very cobbly clay loam. The depth to fractured bedrock is 10 to 20 inches.

Included in this unit are small areas of Redcliff and Ruckles soils. Also included are small areas of soils that are similar to the Lickskillet soil but are less than 10 inches deep over bedrock and small areas of Rock outcrop. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate in the Lickskillet soil. Available water capacity is 1 to 2 inches. The effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is very high.

This unit is used mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on this unit is dominated by bluebunch wheatgrass and lomatium.

Bluebunch wheatgrass is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 800 pounds per acre in favorable years and 300 pounds per acre in unfavorable years. Livestock access is limited by the rock fragments on the surface and the slope.

If the condition of the site deteriorates through overgrazing, bluebunch wheatgrass loses vigor and decreases in extent. Sandberg bluegrass and lomatium increase in extent. If deterioration continues, cheatgrass and other annual plants invade the site.

Mechanical treatment for brush control and range seeding is not practical because of the slope.

The Lickskillet soil is in the Shallow South 9-12pz range site.

97E—Lickskillet-Rock outcrop complex, 35 to 60 percent south slopes. This map unit is on hills. Areas are irregular in shape and are 100 to 400 acres in size. The native vegetation is mainly bunchgrasses, forbs, and shrubs. Elevation is 2,400 to 3,600 feet. The average annual precipitation is 10 to 12 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 110 to 130 days.

This unit is about 55 percent Lickskillet very cobbly loam 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 selected scale.

Included in this unit are small areas of Brownscombe soils. Also included are small areas of soils that are similar to the Lickskillet soil but are less than 10 inches deep over bedrock. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Lickskillet soil is shallow and well drained. It formed in colluvium derived from metavolcanic rocks. Typically, the surface layer is dark brown very cobbly loam about 5 inches thick. The substratum is dark yellowish brown very gravelly loam. It extends to a depth of about 17 inches. The depth to bedrock is 10 to 20 inches.

Permeability is moderate in the Lickskillet soil. Available water capacity is 1 to 2 inches. The effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is high or very high.

This unit is used mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on the Lickskillet soil is dominated by bluebunch wheatgrass and lomatium.

Bluebunch wheatgrass is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 800 pounds per acre in favorable years and 300 pounds per acre in unfavorable years. Livestock access is limited by the rock fragments on the surface, the slope, and the Rock outcrop.

If the condition of the site deteriorates through overgrazing, bluebunch wheatgrass loses vigor and decreases in extent. Sandberg bluegrass and lomatium increase in extent. If deterioration continues, cheatgrass and other annual plants invade the site.

Mechanical treatment for brush control and range seeding is not practical because of the Rock outcrop, the very cobbly surface layer, and the slope.

The Lickskillet soil is in the Shallow South 9-12pz range site.

98C—Lookout silt loam, 2 to 12 percent slopes. This well drained soil is on hills. It is moderately deep to a duripan. It formed in colluvium derived from basalt and influenced by volcanic ash and loess in the surface layer. Areas are long and rectangular and are 40 to 200 acres in size. The native vegetation is mainly bunchgrasses, forbs, and shrubs. Elevation is 2,800 to 3,600 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 45 to 48 degrees F, and the average frost-free period is 110 to 140 days.

Typically, the surface layer is dark grayish brown silt loam about 9 inches thick. The upper part of the subsoil is about 15 inches of brown silty clay and clay. The lower part is a pale brown duripan about 21 inches thick. The depth to a duripan is 20 to 40 inches. The depth to bedrock is 30 to 50 inches.

Included in this unit are small areas of Ruckles, Ruclick, and Virtue soils. Also included are small areas of Lookout soils that have a very cobbly surface layer. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is slow above the duripan in the Lookout soil. Available water capacity is 3 to 7 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 mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on this unit is dominated by Idaho fescue and Wyoming big sagebrush.

Idaho fescue is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 1,500 pounds per acre in favorable years and 500 pounds per acre in unfavorable years.

If the condition of the site deteriorates through overgrazing, Idaho fescue loses vigor and decreases in extent. Wyoming big sagebrush, bluebunch wheatgrass, and Sandberg bluegrass increase in extent. If deterioration continues, the extent of bluebunch wheatgrass decreases, the extent of Sandberg bluegrass and Wyoming big sagebrush strongly increases, and annuals invade the site.

The Lookout soil is in the Mountain Clayey 9-12pz range site.

99C—Lookout very cobbly silt loam, 2 to 12 percent slopes. This well drained soil is on hills. It is moderately deep to a duripan. It formed in colluvium derived from basalt and influenced by volcanic ash and loess in the surface layer. Areas are long and rectangular and are 40 to 200 acres in size. The native vegetation is mainly bunchgrasses, forbs, and shrubs. Elevation is 2,800 to 3,600 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 45 to 48 degrees F, and the average frost-free period is 110 to 140 days.

Typically, the surface layer is dark grayish brown very cobbly silt loam about 7 inches thick. The next 8 inches is dark brown very cobbly silt loam. The next 11 inches is dark yellowish brown clay. Below this is a pale brown duripan about 7 inches thick. The depth to a duripan is 20 to 40 inches. The depth to bedrock is 30 to 50 inches.

Included in this unit are small areas of Ruckles and Ruclick soils. Also included are small areas of Virtue soils. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is slow above the duripan in the Lookout soil. Available water capacity is 3 to 6 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 mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on this unit is dominated by Idaho fescue and Wyoming big sagebrush.

Idaho fescue is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 1,500 pounds per acre in favorable years and 500 pounds per acre in unfavorable years. Livestock access is limited by the rock fragments on the surface.

If the condition of the site deteriorates through overgrazing, Idaho fescue loses vigor and decreases in extent. Wyoming big sagebrush, bluebunch wheatgrass, and Sandberg bluegrass increase in extent. If deterioration continues, the extent of bluebunch wheatgrass decreases, the extent of Sandberg bluegrass and Wyoming big sagebrush strongly increases, and annuals invade the site.

Mechanical treatment for brush control and range seeding is not practical because of the very cobbly surface layer.

The Lookout soil is in the Mountain Clayey 9-12pz range site.

100D—Lostbasin very channery loam, 12 to 35 percent south slopes. This moderately deep, well drained soil is on hills. It formed in colluvium derived from schist and graywacke. Areas are irregular in shape and are 80 to 400 acres in size. The native vegetation is mainly bunchgrasses, forbs, and shrubs. Elevation is 4,000 to 5,300 feet. The average annual precipitation is 12 to 16 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 70 to 100 days.

Typically, the surface layer is dark grayish brown very channery loam about 5 inches thick. The upper part of the subsoil is brown extremely channery clay loam about 8 inches thick. The lower part is dark yellowish brown extremely channery clay loam about 15 inches thick. The depth to bedrock is 20 to 40 inches.

Included in this unit are small areas of soils that are similar to the Lostbasin soil but are less than 20 inches deep over bedrock and small areas of Rock outcrop. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate in the Lostbasin soil. Available water capacity is 1 to 4 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 mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on this unit is dominated by bluebunch wheatgrass, Idaho fescue, mountain big sagebrush, and squaw apple.

Bluebunch wheatgrass and Idaho fescue are the major forage-producing plants. If the site is in excellent condition, the total annual production is estimated at 1,400 pounds per acre in favorable years and 700 pounds per acre in unfavorable years. Livestock access is limited by the rock fragments on the surface.

If the condition of the site deteriorates through overgrazing, bluebunch wheatgrass and Idaho fescue lose vigor and decrease in extent. Sandberg bluegrass and big sagebrush increase in extent. If deterioration continues, cheatgrass and other annual grasses and forbs invade the site.

Mechanical treatment for brush control and range seeding is not practical because of the extremely channery surface layer.

The Lostbasin soil is in the Mountain South 12-16pz range site.

101E—Lostbasin-Xerorthents-Rock outcrop complex, 35 to 50 percent south slopes. This map unit is on hills. Areas are irregular in shape and are 80 to 400 acres in size. The native vegetation is mainly bunchgrasses, forbs, and shrubs. Elevation is 4,000 to 5,300 feet. The average annual precipitation is 12 to 16 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 70 to 100 days.

This unit is about 55 percent Lostbasin very channery loam, 20 percent Xerorthents, and 15 percent Rock outcrop. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of Sinker and Harlow soils. Also included are small areas of soils that are similar to the Lostbasin soil but are less than 20 inches deep over bedrock. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

The Lostbasin soil is moderately deep and well drained. It formed in colluvium derived from schist and graywacke. Typically, the surface layer is dark grayish brown very channery loam about 5 inches thick. The upper part of the subsoil is brown extremely channery clay loam about 8 inches thick. The lower part is dark yellowish brown extremely channery clay loam about 15 inches thick. The depth to bedrock is 20 to 40 inches.

Permeability is moderate in the Lostbasin soil. Available water capacity is 1 to 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

The Xerorthents are very shallow to deep and are well drained or somewhat excessively drained. They formed in colluvium and residuum derived from schist. Typically, the surface layer is grayish brown extremely channery loam about 14 inches thick. The subsoil is yellowish brown extremely channery loam. It extends to a depth of about 29 inches The depth to fractured bedrock is mainly 5 to 60 inches.

Permeability is moderate or moderately rapid in the Xerorthents. Available water capacity is 1 to 8 inches. The effective rooting depth is mainly 5 to 60 inches. Runoff is rapid, and the hazard of water erosion is very high.

This unit is used mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on the Lostbasin soil is dominated by bluebunch wheatgrass, Idaho fescue, big sagebrush, and squaw apple.

Bluebunch wheatgrass and Idaho fescue are the major forage-producing plants. If the site is in excellent condition, the total annual production is estimated at 1,400 pounds per acre in favorable years and 700 pounds per acre in unfavorable years. Livestock access is limited by the slope, the Rock outcrop, and the rock fragments on the surface.

The potential plant community on the Xerorthents is dominated by curlleaf mountainmahogany, bluebunch wheatgrass, western juniper, and bitterbrush.

Bluebunch wheatgrass and Idaho fescue are the major forage-producing plants. If the site is in excellent condition, the total annual production is estimated at 1,300 pounds per acre in favorable years and 600 pounds per acre in unfavorable years.

If the condition of the site deteriorates through overgrazing, bluebunch wheatgrass, Idaho fescue, curlleaf mountainmahogany, and antelope bitterbrush lose vigor and decrease in extent. Western juniper, mountain big sagebrush, and Sandberg bluegrass increase in extent. If deterioration continues, cheatgrass and other annual grasses and forbs invade the site.

Brush control is not advisable because of the value of palatable shrubs in this unit for wildlife.

The Lostbasin soil is in the Mountain South 12-16pz range site. The Xerorthents are in the Mahogany Rockland 12+pz range site.

102C—Lovline channery loam, 2 to 12 percent slopes. This moderately deep, well drained soil is on hills. It formed in colluvium derived from schist. Areas are irregular in shape and are 40 to 200 acres in size. The native vegetation is mainly bunchgrasses, forbs, and shrubs. Elevation is 2,000 to 3,600 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 45 to 49 degrees F, and the average frost-free period is 100 to 140 days.

Typically, the surface layer is very dark grayish brown channery loam about 9 inches thick. The subsoil is dark brown channery loam. It extends to a depth of about 38 inches. The depth to bedrock is 20 to 40 inches.

Included in this unit are small areas of Snaker and Darkcanyon soils. Also included are small areas of soils that are similar to the Lovline soil but are more than 40 inches deep over bedrock. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate in the Lovline soil. Available water capacity is 3 to 6 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 mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on this unit is dominated by bluebunch wheatgrass, Thurber needlegrass, and Wyoming big sagebrush.

Bluebunch wheatgrass and Thurber needlegrass are the major forage-producing plants. If the site is in excellent condition, the total annual production is estimated at 1,500 pounds per acre in favorable years and 500 pounds per acre in unfavorable years.

If the condition of the site deteriorates through overgrazing, bluebunch wheatgrass and Thurber needlegrass lose vigor and decrease in extent. Sandberg bluegrass and Wyoming big sagebrush increase in extent. If deterioration continues, cheatgrass and other annual plants strongly invade the site.

The Lovline soil is in the Loamy 9-12pz range site.

103D—Lovline channery loam, 12 to 30 percent north slopes. This moderately deep, well drained soil is on hills. It formed in colluvium derived from schist. Areas are irregular in shape and are 40 to 400 acres in size. The native vegetation is mainly bunchgrasses, forbs, and shrubs. Elevation is 2,000 to 3,600 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 45 to 49 degrees F, and the average frost-free period is 100 to 140 days.

Typically, the surface layer is very dark grayish brown channery loam about 9 inches thick. The subsoil is dark brown channery loam. It extends to a depth of about 38 inches. The depth to bedrock is 20 to 40 inches.

Included in this unit are small areas of Snaker and Darkcanyon soils. Also included are small areas of soils that are similar to the Lovline soil but are more than 40 inches deep over bedrock. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate in the Lovline soil. Available water capacity is 3 to 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 mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on this unit is dominated by Idaho fescue, bluebunch wheatgrass, and Wyoming big sagebrush.

Idaho fescue and bluebunch wheatgrass are the major forage-producing plants. If the site is in excellent condition, the total annual production is estimated at 1,700 pounds per acre in favorable years and 600 pounds per acre in unfavorable years.

If the condition of the site deteriorates through overgrazing, Idaho fescue loses vigor and decreases in extent. Bluebunch wheatgrass, Sandberg bluegrass, and big sagebrush increase in extent. If deterioration continues, the extent of bluebunch wheatgrass decreases and other annual grasses and forbs invade the site.

The Lovline soil is in the North 9-12pz range site.

103E—Lovline channery loam, 30 to 50 percent north slopes. This moderately deep, well drained soil is on hills. It formed in colluvium derived from schist. Areas are irregular in shape and are 100 to 400 acres in size. The native vegetation is mainly bunchgrasses, forbs, and shrubs. Elevation is 2,000 to 3,600 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 45 to 49 degrees F, and the average frost-free period is 100 to 140 days.

Typically, the surface layer is very dark grayish brown channery loam about 9 inches thick. The subsoil is dark brown channery loam. It extends to a depth of about 38 inches. The depth to bedrock is 20 to 40 inches.

Included in this unit are small areas of Snaker and Darkcanyon soils. Also included are small areas of soils that are similar to the Lovline soil but are more than 40 inches deep over bedrock. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate in the Lovline soil. Available water capacity is 3 to 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 mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on this unit is dominated by Idaho fescue, bluebunch wheatgrass, and Wyoming big sagebrush.

Idaho fescue and bluebunch wheatgrass are the major forage-producing plants. If the site is in excellent condition, the total annual production is estimated at 1,700 pounds per acre in favorable years and 600 pounds per acre in unfavorable years. Livestock access is limited by the slope.

If the condition of the site deteriorates through overgrazing, Idaho fescue loses vigor and decreases in extent. Bluebunch wheatgrass, Sandberg bluegrass, and big sagebrush increase in extent. If deterioration continues, the extent of bluebunch wheatgrass decreases and cheatgrass and other annual grasses and forbs invade the site.

Mechanical treatment for brush control and range seeding is not practical because of the slope.

The Lovline soil is in the North 9-12pz range site.

103F—Lovline channery loam, 50 to 70 percent north slopes. This moderately deep, well drained soil is on hills. It formed in colluvium derived from schist. Areas are irregular in shape and are 100 to 400 acres in size. The native vegetation is mainly bunchgrasses, forbs, and shrubs. Elevation is 2,000 to 3,600 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 45 to 49 degrees F, and the average frost-free period is 100 to 140 days.

Typically, the surface layer is very dark grayish brown channery loam about 9 inches thick. The subsoil is dark brown channery loam. It extends to a depth of about 38 inches. The depth to bedrock is 20 to 40 inches.

Included in this unit are small areas of Snaker and Darkcanyon soils. Also included are small areas of soils that are similar to the Lovline soil but are more than 40 inches deep over bedrock. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate in the Lovline soil. Available water capacity is 3 to 6 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is very high.

This unit is used mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on this unit is dominated by Idaho fescue, bluebunch wheatgrass, and Wyoming big sagebrush.

Idaho fescue and bluebunch wheatgrass are the major forage-producing plants. If the site is in excellent condition, the total annual production is estimated at 1,700 pounds per acre in favorable years and 600 pounds per acre in unfavorable years. Livestock access is limited by the slope.

If the condition of the site deteriorates through overgrazing, Idaho fescue loses vigor and decreases in extent. Bluebunch wheatgrass, Sandberg bluegrass, and big sagebrush increase in extent. If deterioration continues, the extent of bluebunch wheatgrass decreases and cheatgrass and other annual grasses and forbs invade the site.

Mechanical treatment for range seeding and brush control is not practical because of the slope.

The Lovline soil is in the North 9-12pz range site.

104D—Marack silt loam, 12 to 35 percent north slopes. This deep, well drained soil is on low terraces. It formed in mixed lacustrine sediments. Areas are irregular in shape and are 100 to 400 acres in size. The native vegetation is mainly bunchgrasses, forbs, and shrubs. Elevation is 3,800 to 4,400 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 60 to 90 days.

Typically, the surface layer is very dark grayish brown silt loam about 12 inches thick. The upper 13 inches of the subsoil is dark brown and dark yellowish brown clay and silty clay. The lower 22 inches is yellowish brown clay loam and very gravelly loam. The depth to lacustrine sediments is typically 40 to 60 inches but is more than 60 inches in some areas.

Included in this unit are small areas of Marack soils that have a surface layer of gravelly silty clay loam. Also included are small areas of soils that are similar to the Marack soil but are less than 40 inches deep to lacustrine sediments. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate to a depth of about 12 inches in the Marack soil and slow below that depth. Available water capacity is 6 to 9 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 livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on this unit is dominated by Idaho fescue and Wyoming big sagebrush.

Idaho fescue is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 1,700 pounds per acre in favorable years and 600 pounds per acre in unfavorable years.

If the condition of the site deteriorates through overgrazing, Idaho fescue loses vigor and decreases in extent. Sandberg bluegrass and Wyoming big sagebrush increase in extent. If deterioration continues, annual grasses and forbs invade the site.

The Marack soil is in the Mountain North 9-12pz range site.

105C—Marack gravelly silty clay loam, 2 to 12 percent slopes. This deep, well drained soil is on low terraces. It formed in mixed lacustrine sediments. Areas are irregular in shape and are 100 to 400 acres in size. The native vegetation is mainly bunchgrasses, forbs, and shrubs. Elevation is 3,800 to 4,400 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 60 to 90 days.

Typically, the surface layer is very dark grayish brown gravelly silty clay loam about 12 inches thick. The upper 13 inches of the subsoil is dark brown and dark yellowish brown clay and silty clay. The lower 22 inches is yellowish brown clay loam and very gravelly loam. The depth to lacustrine sediments is typically 40 to 60 inches but is more than 60 inches in some areas.

Included in this unit are small areas of Marack soils that have a surface layer of silt loam. Also included are small areas of soils that are similar to the Marack soil but are less than 40 inches deep to lacustrine sediments. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderately slow to a depth of about 12 inches in the Marack soil and slow below that depth. Available water capacity is 5 to 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 mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on this unit is dominated by Idaho fescue and Wyoming big sagebrush.

Idaho fescue is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 1,500 pounds per acre in favorable years and 500 pounds per acre in unfavorable years.

If the condition of the site deteriorates through overgrazing, Idaho fescue loses vigor and decreases in extent. Wyoming big sagebrush, bluebunch wheatgrass, and Sandberg bluegrass increase in extent. If deterioration continues, the extent of bluebunch wheatgrass decreases and unpalatable annual grasses and forbs invade the site.

The Marack soil is in the Mountain Clayey 9-12pz range site.

106D—Marack very gravelly silty clay loam, 12 to 35 percent south slopes. This deep, well drained soil is on low terraces. It formed in lacustrine sediments. Areas are irregular in shape and are 100 to 400 acres in size. The native vegetation is mainly bunchgrasses, shrubs, and forbs. Elevation is 3,800 to 4,400 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 60 to 90 days.

Typically, the surface layer is very dark grayish brown very gravelly silty clay loam about 12 inches thick. The upper 13 inches of the subsoil is dark brown and dark yellowish brown clay and silty clay. The lower 22 inches is yellowish brown clay loam and very gravelly loam. The depth to lacustrine sediments is typically 40 to 60 inches but is more than 60 inches in some areas.

Included in this unit are small areas of Marack soils that have a surface layer of silt loam and small areas of Badland. Also included are small areas of soils that are similar to the Marack soil but are less than 40 inches deep to lacustrine sediments. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderately slow to a depth of about 12 inches in the Marack soil and slow below that depth. Available water capacity is 5 to 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 livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on this unit is dominated by bluebunch wheatgrass and Wyoming big sagebrush.

Bluebunch wheatgrass is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 1,200 pounds per acre in favorable years and 400 pounds per acre in unfavorable years. Livestock access on this unit may be limited by the rock fragments on the surface.

If the condition of the site deteriorates through overgrazing, bluebunch wheatgrass loses vigor and decreases in extent. Sandberg bluegrass and Wyoming big sagebrush increase in extent. If deterioration continues, cheatgrass and other annual grasses and forbs invade the site.

Mechanical treatment for range seeding and brush control may be limited by the very gravelly surface layer.

The Marack soil is in the Clayey South 9-12pz range site.

107C—Marack complex, 2 to 12 percent slopes. This map unit is on low terraces. Areas are irregular in shape and are 100 to 400 acres in size. The native vegetation is mainly bunchgrasses, forbs, and shrubs. Elevation is 3,800 to 4,400 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 60 to 90 days.

This unit is about 50 percent Marack gravelly silty clay loam and 40 percent Marack silt loam. Marack gravelly silty clay loam is in convex areas, and Marack silt loam is in concave areas.

Included in this unit are small areas of soils that are similar to the Marack soils but are less than 40 inches deep to lacustrine sediments. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

The Marack soils are deep and well drained. They formed in lacustrine sediments. Typically, the surface layer is about 12 inches of very dark grayish brown gravelly silty clay loam or silt loam. The upper 13 inches of the subsoil is dark brown and dark yellowish brown clay and silty clay. The lower 22 inches is yellowish brown clay loam and very gravelly loam. The depth to lacustrine sediments is typically 40 to 60 inches but is more than 60 inches in some areas.

Permeability is moderate or moderately slow to a depth of about 12 inches in the Marack soils and slow below that depth. Available water capacity is 5 to 9 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 mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on this unit is dominated by Idaho fescue and Wyoming big sagebrush.

Idaho fescue is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 1,500 pounds per acre in favorable years and 500 pounds per acre in unfavorable years.

If the condition of the site deteriorates through overgrazing, Idaho fescue loses vigor and decreases in extent. Wyoming big sagebrush, bluebunch wheatgrass, and Sandberg bluegrass increase in extent. If deterioration continues, the extent of bluebunch wheatgrass decreases and annual grasses and forbs invade the site.

The Marack soils are in the Mountain Clayey 9-12pz range site.

108D—Marack-Badland complex, 8 to 40 percent slopes. This map unit is on the side slopes of low terraces. It formed in lacustrine sediments. Areas are irregular in shape and are 40 to 200 acres in size. The native vegetation is mainly bunchgrasses, shrubs, and forbs. Elevation is 3,800 to 4,400 feet. The average annual precipitation is about 9 to 12 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 60 to 90 days.

This unit is about 55 percent Marack very gravelly silty clay loam and 30 percent Badland. The Marack soil has slopes of as much as about 30 percent, and the Badland has slopes of about 20 to 40 percent. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of Marack soils that have a surface layer of silt loam. Also included are small areas of Campcreek soils and soils that are similar to the Marack soil but are less than 40 inches deep to lacustrine sediments. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Marack soil is deep and well drained. Typically, the surface layer is very dark grayish brown very gravelly silty clay loam about 12 inches thick. The upper 13 inches of the subsoil is dark brown and dark yellowish brown clay and silty clay. The lower 22 inches is yellowish brown clay loam and very gravelly loam. The depth to lacustrine sediments is typically 40 to 60 inches but is more than 60 inches in some areas.

Permeability is moderately slow to a depth of about 12 inches in the Marack soil and slow below that depth. Available water capacity is 5 to 8 inches. The effective rooting depth is 40 to 60 inches. Runoff is medium, and the hazard of water erosion is moderate or high.

The Badland is dominated by exposed silty, clayey, or gravelly alluvial sediments on terrace escarpments. These areas are severely eroded and nearly barren of vegetation. Runoff is medium, and the hazard of water erosion is moderate or high.

This unit is used mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on the Marack soil is dominated by bluebunch wheatgrass and Wyoming big sagebrush.

Bluebunch wheatgrass is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 1,200 pounds per acre in favorable years and 400 pounds per acre in unfavorable years. Livestock access on this unit may be limited by the rock fragments on the surface.

If the condition of the site deteriorates through overgrazing, bluebunch wheatgrass loses vigor and decreases in extent. Sandberg bluegrass and Wyoming big sagebrush increase in extent. If deterioration continues, annual grasses and forbs invade the site.

Mechanical treatment for range seeding and brush control on the Marack soil may be limited by the very gravelly surface layer. The Badland is unsuitable for livestock grazing and is best left in its natural state.

The Marack soil is in the Clayey South 9-12pz range site.

109C—McEwen silt loam, 2 to 12 percent slopes. This deep, well drained soil is on alluvial terraces and side slopes. It formed in mixed alluvium influenced by loess and volcanic ash in the surface layer. Areas are irregular in shape and are 100 to 500 acres in size. The native vegetation is mainly conifers, shrubs, and grasses. Elevation is 3,900 to 4,400 feet. The average annual precipitation is 16 to 24 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 50 to 90 days.

Typically, the surface is covered with a mat of partially decomposed needles, leaves, and twigs about 1 inch thick. The surface layer is dark brown silt loam about 12 inches thick. The upper 6 inches of the subsoil is dark brown clay loam. The lower 25 inches is dark reddish brown clay loam. The substratum to a depth of about 60 inches is dark reddish brown extremely gravelly loam. The depth to the very or extremely gravelly alluvium is 40 to 60 inches.

Included in this unit are small areas of Rouen, Highhorn, and Huntrock soils. Also included are small areas of Webfoot soils on slightly lower adjacent terraces. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderately slow in the McEwen soil. Available water capacity is 7 to 10 inches. The effective rooting depth is limited by the extremely gravelly substratum at a depth of 40 to 60 inches. Runoff is slow or medium, and the hazard of water erosion is slight or moderate.

Most areas are used for timber production. A few areas are used for homesite development or for hay and pasture. This unit also provides habitat for many kinds of wildlife.

Woodland.—This unit is suited to the production of ponderosa pine. The mean site index is 71 for ponderosa pine (100-year base age). The potential production at culmination of the mean annual increment for ponderosa pine is 56 cubic feet per acre per year (3.9 cubic meters per hectare per year) in a 50-year-old, even-aged, fully stocked stand.

The main concerns in producing and harvesting timber are equipment limitations and plant competition.

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. The risk of compaction can be reduced by using low-pressure ground equipment, laying out skid trails in advance, and harvesting timber when the soil is least susceptible to compaction.

Careful management of reforestation is needed to minimize competition from undesirable plants. If the site is not adequately prepared, plant competition can prevent or delay the reestablishment of volunteer or planted trees. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying. Trees suitable for planting are ponderosa pine and Douglas-fir.

Grazable woodland.—This unit is suitable for use as grazable woodland. The understory consists mainly of common snowberry, spirea, elk sedge, pinegrass, Idaho fescue, and strawberry. The potential production of the native understory plants in normal years is about 800 pounds of air-dry forage per acre.

A system that results in proper grazing use is essential if livestock graze this unit. Timely deferment of grazing is needed to allow the desirable plants to mature and set seed. Grazing should be delayed in spring until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.

Seeding disturbed areas to suitable plants increases forage production. Deferred grazing or exclusion is necessary for the establishment of tree seedlings.

This soil can produce adequate forage for big game animals after the tree canopy is opened by logging, fire, or some other disturbance.

Hay and pasture.—Areas of this map unit that have been cleared of trees and brush are suited to hay and pasture.

The management practices that maintain optimum vigor and quality of irrigated forage plants are proper stocking rates, pasture rotation, and restricted grazing during wet periods. Periodic mowing, clipping, and dragging to spread droppings help to maintain uniform growth and prevent selective grazing.

Fertilizer is needed to ensure the optimum growth of grasses and legumes. A cropping system that includes grasses, legumes, or grass-legume mixtures helps to maintain soil fertility and tilth.

In summer irrigation is needed for the maximum production of hay and pasture. Sprinkler irrigation is the most suitable method of applying water. It permits the even, controlled application of water, helps to control runoff, and minimizes the risk of erosion. To avoid 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.

Conducting fieldwork during wet periods results in deterioration of tilth and destroys soil structure. As a result, it increases the runoff rate and the hazard of erosion. All tillage should be on the contour or across the slope.

Homesite development.—If this unit is used for homesite development, the main limitations are the moderately slow permeability, low strength, a moderate shrink-swell potential, and the slope.

On sites for septic tank absorption fields, the moderately slow permeability can be overcome by increasing the size of the absorption fields, by providing sandy backfill for the trench, and by installing long absorption lines. The slope can hinder installation of the absorption fields. The absorption lines should be installed on the contour.

Properly designing roads and streets helps to offset the limited ability of the soil to support a load and helps to prevent the damage caused by shrinking and swelling.

Properly designing the foundations and footings of buildings and diverting runoff away from the buildings help to prevent the structural damage caused by shrinking and swelling.

The hazard of erosion is increased if the soil is left exposed during site development. In the steeper areas this hazard can be reduced by disturbing only the part of the site that is used for construction.

The McEwen soil is in the Pine-Snowberry-Sedge woodland understory site.

110D—McEwen gravelly silt loam, 12 to 20 percent slopes. This deep, well drained soil is on alluvial terraces and side slopes. It formed in mixed alluvium influenced by loess and volcanic ash in the surface layer. Areas are irregular in shape and are 40 to 100 acres in size. The native vegetation is mainly conifers, shrubs, and grasses. Elevation is 3,900 to 4,400 feet. The average annual precipitation is 16 to 24 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 50 to 90 days.

Typically, the surface is covered with a mat of partially decomposed needles, leaves, and twigs about 1 inch thick. The surface layer is dark brown gravelly silt loam about 12 inches thick. The upper 6 inches of the subsoil is dark brown clay loam. The lower 25 inches is dark reddish brown clay loam. The substratum to a depth of about 60 inches is dark reddish brown extremely gravelly loam. Depth to the very or extremely gravelly alluvium is 40 to 60 inches.

Included in this unit are small areas of Highhorn, Huntrock, and Rouen soils. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderately slow in the McEwen soil. Available water capacity is 7 to 10 inches. The effective rooting depth is limited by the extremely gravelly substratum at a depth of 40 to 60 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used mainly for timber production. It also provides habitat for many kinds of wildlife.

Woodland.—This unit is suited to the production of ponderosa pine. The mean site index is 71 for ponderosa pine (100-year base age). The potential production at culmination of the mean annual increment for ponderosa pine is 56 cubic feet per acre per year (3.9 cubic meters per hectare per year) in a 50-year-old, even-aged, fully stocked stand.

The main concerns in producing and harvesting timber are the hazard of erosion, the equipment limitation, and plant competition.

Minimizing the risk of erosion is essential in areas where timber is harvested. Properly designed road drainage systems that include carefully located culverts help to control erosion. Spoil from excavations is subject to rill and gully erosion and to sloughing. Roads, landings, skid trails, and firebreaks can be protected against erosion by constructing water bars and by seeding areas that have been cut and filled. Buffer strips may be needed in areas adjacent to perennial streams to minimize siltation and maintain stream temperatures.

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. The risk of compaction can be reduced by using low-pressure ground equipment, laying out skid trails in advance, and harvesting timber when the soil is dry or frozen.

Careful management of reforestation is needed to minimize competition from undesirable plants. If the site is not adequately prepared, plant competition can prevent or delay the reestablishment of volunteer or planted trees. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying. Trees suitable for planting are ponderosa pine and Douglas-fir.

Grazable woodland.—This unit is suitable for use as grazable woodland. The understory consists mainly of common snowberry, spirea, elk sedge, pinegrass, Idaho fescue, and strawberry. The potential production of the native understory plants in normal years is about 800 pounds of air-dry forage per acre.

A system that results in proper grazing use is essential if livestock graze this unit. Timely deferment of grazing is needed to allow the desirable plants to mature and set seed. Grazing should be delayed in spring until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.

Seeding disturbed areas to suitable plants increases forage production. Deferred grazing is needed during periods when seedlings are becoming established.

This soil can produce adequate forage for big game animals after the tree canopy is opened by logging, fire, or some other disturbance.

The McEwen soil is in the Pine-Snowberry-Sedge woodland understory site.

111D—McGarr-Kahler complex, 12 to 35 percent north slopes. This map unit is on mountains. Areas are irregular in shape and are 100 to 400 acres in size. The native vegetation is mainly conifers, shrubs, and grasses. Elevation is 4,400 to 5,800 feet. The average annual precipitation is 20 to 30 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 30 to 50 days.

This unit is about 45 percent McGarr very stony loam and 40 percent Kahler loam. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of Hall Ranch and Klicker soils. Also included are small areas of Rock outcrop. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The McGarr soil is moderately deep and well drained. It formed in mixed volcanic ash, loess, and colluvium derived from andesite and basalt. Typically, the surface layer is very dark grayish brown very stony loam about 4 inches thick. The next layer is very dark grayish brown gravelly loam about 9 inches thick. The upper 9 inches of the subsoil is dark brown gravelly loam. The lower 7 inches is dark brown gravelly clay loam. The depth to bedrock is 20 to 40 inches.

Permeability is moderately slow in the McGarr soil. Available water capacity is 3 to 7 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate or high.

The Kahler soil is deep and well drained. It formed in mixed volcanic ash, loess, and colluvium derived from andesite and basalt. Typically, the surface layer is very dark gray loam about 5 inches thick. The next layer is very dark grayish brown silty clay loam about 8 inches thick. The upper 9 inches of the subsoil is dark brown gravelly loam. The lower 15 inches is dark brown gravelly silty clay loam. The substratum to a depth of about 60 inches is dark brown loam. The depth to bedrock is typically more than 60 inches but is 40 to 60 inches in some areas.

Permeability is moderately slow in the Kahler soil. Available water capacity is 8 to 12 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 mainly for timber production. It also is used for livestock grazing, and it provides habitat for many kinds of wildlife.

Woodland.—The McGarr soil is suited to the production of ponderosa pine. The mean site index is 68 for ponderosa pine (100-year base age). The potential production at culmination of the mean annual increment for ponderosa pine is 53 cubic feet per acre per year (3.7 cubic meters per hectare per year) in a 50-year-old, even-aged, fully stocked stand.

The Kahler soil is suited to the production of Douglas-fir and ponderosa pine. The mean site index is 67 for Douglas-fir (50-year base age) and 83 for ponderosa pine (100-year base age). The potential production at culmination of the mean annual increment for Douglas-fir is 56 cubic feet per acre per year (3.9 cubic meters per hectare per year) in a 105-year-old, even-aged, fully stocked stand and for ponderosa pine is 74 cubic feet per acre per year (5.2 meters per hectare per year) in a 40-year-old, even-aged, fully stocked stand.

The main concerns in producing and harvesting timber are the hazard of erosion, the equipment limitation, seedling mortality, plant competition, the hazard of windthrow, and fire damage to the soil.

Minimizing the risk of erosion is essential in areas where timber is harvested. Properly designed road drainage systems that include carefully located culverts help to control erosion. Spoil from excavations is subject to rill and gully erosion and to sloughing. Roads, landings, skid trails, and firebreaks can be protected against erosion by constructing water bars and by seeding areas that have been cut and filled. Buffer strips may be needed in areas adjacent to perennial streams to minimize siltation and maintain stream temperatures.

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. The risk of compaction can be reduced by using low-pressure ground equipment, laying out skid trails in advance, and harvesting timber when the soil is dry or frozen. Compaction limits the movement of water and air in the soil and restricts the growth of roots. Stones on the surface of the McGarr soil can interfere with felling, yarding, and other activities involving the use of equipment. Cable yarding systems that partially or fully suspend logs generally do less damage to the soil than conventional ground-based systems.

Careful management of reforestation is needed to minimize competition from undesirable plants. If the site is not adequately prepared, plant competition can prevent or delay the reestablishment of volunteer or planted trees. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying.

The seedling mortality rate is increased by compaction of the surface layer. A low available water capacity generally limits seedling survival on the McGarr soil in areas where understory plants are numerous. Shading and mulching of seedlings may be required on the McGarr soil. The trees that are suitable for planting include ponderosa pine and Douglas-fir.

Trees are subject to windthrow because of the limited rooting depth in the McGarr soil. Regeneration systems that isolate single trees or groups of trees are not practical because of the hazard of windthrow.

Some decline in forest productivity may result from fire of moderate intensity.

Grazable woodland.—This unit is suitable for use as grazable woodland. The understory on the McGarr soil consists mainly of common snowberry, spirea, Idaho fescue, elk sedge, pinegrass, and strawberry. The potential production of the native understory plants in a normal year is about 800 pounds of air-dry forage per acre.

The understory on the Kahler soil consists mainly of princes pine, low Oregongrape, myrtle pachystima, elk sedge, pinegrass, and heartleaf arnica.

A system that results in proper grazing use is essential if livestock graze this unit. Timely deferment of grazing is needed to allow the desirable plants to mature and set seed. Grazing should be delayed in spring until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.

The suitability of this unit for seeding is fair. The main limitation for seeding is the very stony surface of the McGarr soil. Seeding disturbed areas to suitable plants increases forage production. Deferred grazing is needed during periods when seedlings are becoming established.

This soil can produce adequate forage for big game animals after the tree canopy is opened by logging, fire, or some other disturbance. Stands of timber should be left in some areas to provide escape and thermal cover for the big game animals.

The McGarr soil is in the Pine-Snowberry-Sedge woodland understory site. The Kahler soil is in the Fir-Pine-Sedge woodland understory site.

111E—McGarr-Kahler complex, 35 to 60 percent north slopes. This map unit is on mountains. Areas are irregular in shape and are 100 to 400 acres in size. The native vegetation is mainly conifers, shrubs, and grasses. Elevation is 4,400 to 5,800 feet. The average annual precipitation is 20 to 30 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 30 to 50 days.

This unit is about 55 percent McGarr very stony loam and 30 percent Kahler loam. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of Hall Ranch and Klicker soils. Also included are small areas of Rock outcrop. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The McGarr soil is moderately deep and well drained. It formed in mixed volcanic ash, loess, and colluvium derived from andesite and basalt. Typically, the surface layer is very dark grayish brown very stony loam about 4 inches thick. The next layer is very dark grayish brown gravelly loam about 9 inches thick. The upper 9 inches of the subsoil is dark brown gravelly loam. The lower 7 inches is dark brown gravelly clay loam. The depth to bedrock is 20 to 40 inches.

Permeability is moderately slow in the McGarr soil. Available water capacity is 3 to 7 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high or very high.

The Kahler soil is deep and well drained. It formed in mixed volcanic ash, loess, and colluvium derived from andesite and basalt. Typically, the surface layer is very dark gray loam about 5 inches thick. The next layer is very dark grayish brown silty clay loam about 8 inches thick. The upper 9 inches of the subsoil is dark brown gravelly loam. The lower 15 inches is dark brown gravelly silty clay loam. The substratum to a depth of about 60 inches is dark brown loam. The depth to bedrock is typically more than 60 inches but is 40 to 60 inches in some areas.

Permeability is moderately slow in the Kahler soil. Available water capacity is 8 to 12 inches. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high or very high.

This unit is used mainly for timber production. It also is used for livestock grazing, and it provides habitat for many kinds of wildlife.

Woodland.—The McGarr soil is suited to the production of ponderosa pine. The mean site index is 68 for ponderosa pine (100-year base age). The potential production at culmination of the mean annual increment for ponderosa pine is 53 cubic feet per acre per year (3.7 cubic meters per hectare per year) in a 50-year-old, even-aged, fully stocked stand.

The Kahler soil is suited to the production of Douglas-fir and ponderosa pine. The mean site index is 67 for Douglas-fir (50-year base age) and 83 for ponderosa pine (100-year base age). The potential production at culmination of the mean annual increment for Douglas-fir is 56 cubic feet per acre per year (3.9 cubic meters per hectare per year) in a 105-year-old, even-aged, fully stocked stand and for ponderosa pine is 74 cubic feet per acre per year (5.2 meters per hectare per year) in a 40-year-old, even-aged, fully stocked stand.

The main concerns in producing and harvesting timber are the hazard of erosion, the equipment limitation, seedling mortality, plant competition, the hazard of windthrow, and fire damage to the soil.

Minimizing the risk of erosion is essential in areas where timber is harvested. Properly designed road drainage systems that include carefully located culverts help to control erosion. Spoil from excavations is subject to rill and gully erosion and to sloughing. Roads, landings, skid trails, and firebreaks can be protected against erosion by constructing water bars and by seeding areas that have been cut and filled. Buffer strips may be needed in areas adjacent to perennial streams to minimize siltation and maintain stream temperatures.

The slope restricts the use of wheeled and tracked equipment on skid trails. High-lead or other logging systems that fully or partially suspend the logs above the ground cause less damage to the soil than tractor systems and reduce the risk of compaction. The risk of compaction also can be reduced by using low-pressure ground equipment, laying out skid trails in advance, and harvesting timber when the soil is dry or frozen. Stones on the surface of the McGarr soil can interfere with felling, yarding, and other activities involving the use of equipment.

Careful management of reforestation is needed to minimize competition from undesirable plants. If the site is not adequately prepared, plant competition can prevent or delay the reestablishment of volunteer or planted trees. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying. Scarification is severely restricted in the steeper areas because of increased expense and soil displacement.

The seedling mortality rate is increased by compaction of the surface layer. A low available water capacity generally limits seedling survival on the McGarr soil in areas where understory plants are numerous. Shading and mulching of seedlings may be required on the McGarr soil. The trees that are suitable for planting include ponderosa pine and Douglas-fir.

Trees are subject to windthrow because of the limited rooting depth in the McGarr soil. Regeneration systems that isolate single trees or groups of trees are not practical because of the hazard of windthrow.

Some decline in forest productivity may result from fire of moderate intensity.

Grazable woodland.—This unit is suitable for use as grazable woodland. The understory on the McGarr soil consists mainly of common snowberry, spirea, Idaho fescue, elk sedge, pinegrass, and strawberry. The potential production of the native understory plants in a normal year is about 800 pounds of air-dry forage per acre.

The understory on the Kahler soil consists mainly of princes pine, low Oregongrape, myrtle pachystima, elk sedge, pinegrass, and heartleaf arnica.

A system that results in proper grazing use is essential if livestock graze this unit. Timely deferment of grazing is needed to allow the desirable plants to mature and set seed. Grazing should be delayed in spring until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.

This soil can produce adequate forage for big game animals after the tree canopy is opened by logging, fire, or some other disturbance. Stands of timber should be left in some areas to provide escape and thermal cover for the big game animals.

The McGarr soil is in the Pine-Snowberry-Sedge woodland understory site. The Kahler soil is in the Fir-Pine-Sedge woodland understory site.

112D—Morningstar extremely gravelly loam, 12 to 35 percent south slopes. This deep, well drained soil is on mountains. It formed in colluvium derived from argillite and rhyolitic tuff. Areas are irregular in shape and are 80 to 200 acres in size. The native vegetation is mainly conifers, shrubs, bunchgrasses, and forbs. Elevation is 4,000 to 5,700 feet. The average annual precipitation is about 16 to 30 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 50 to 90 days.

Typically, the surface layer is very dark grayish brown extremely gravelly loam about 6 inches thick. The upper 17 inches of the subsoil is dark brown extremely gravelly clay loam. The lower 23 inches is dark yellowish brown extremely gravelly sandy clay loam. The substratum to a depth of 60 inches or more is brown extremely gravelly sandy clay loam.

Included in this unit are small areas of Hudspeth, Derringer, and Harlow soils. Also included are small areas of Rock outcrop. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderately slow in the Morningstar soil. Available water capacity is 3 to 7 inches. The effective rooting depth is typically 60 inches or more but is 40 to 60 inches in some areas. Runoff is medium, and the hazard of water erosion is moderate or high.

This unit is used mainly for timber production. It also is used for livestock grazing, and it provides habitat for many kinds of wildlife.

Woodland.—This unit is suited to the production of ponderosa pine. The mean site index is 69 for ponderosa pine (100-year base age). The potential production at culmination of the mean annual increment for ponderosa pine is 54 cubic feet per acre per year (3.8 meters per hectare per year) in a 50-year-old, even-aged, fully stocked stand.

The main concerns in producing and harvesting timber are the hazard of erosion, the equipment limitation, seedling mortality, plant competition, and fire damage to the soil.

Minimizing the risk of erosion is essential in areas where timber is harvested. Properly designed road drainage systems that include carefully located culverts help to control erosion. Spoil from excavations is subject to rill and gully erosion and to sloughing. Roads, landings, skid trails, and firebreaks can be protected against erosion by constructing water bars and by seeding areas that have been cut and filled. Buffer strips may be needed in areas adjacent to perennial streams to minimize siltation and maintain stream temperatures.

Use of standard wheeled and tracked equipment is generally suitable. Maintaining the understory is essential in controlling erosion. Cable yarding systems generally do less damage to the soil than conventional ground-based systems.

Careful management of reforestation is needed to minimize competition from undesirable plants. If the site is not adequately prepared, plant competition can prevent or delay the reestablishment of volunteer or planted trees. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying.

The seedling mortality rate is increased by compaction of the surface layer because compaction limits the movement of water and air in the soil and restricts the growth of roots. Droughtiness in the surface layer and the high content of rock fragments also limit seedling survival. To compensate for the higher expected mortality rate, larger seedlings or a greater number of seedlings than is typical can be planted. Shading and mulching of seedlings may be required. The trees that are suitable for planting include ponderosa pine.

Grazable woodland.—This unit is suitable for use as grazable woodland. The understory consists mainly of common snowberry, antelope bitterbrush, mountain big sagebrush, pinegrass, Idaho fescue, western juniper, and heartleaf arnica. The potential production of the native understory plants in a normal year is about 800 pounds of air-dry forage per acre.

A system that results in proper grazing use is essential if livestock graze this unit. Timely deferment of grazing is needed to allow the desirable plants to mature and set seed. Grazing should be delayed in spring until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.

This soil can produce adequate forage for big game animals after the tree canopy is opened by logging, fire, or some other disturbance. Stands of timber should be left in some areas to provide escape and thermal cover for the big game animals.

The Morningstar soil is in the Pine-Bitterbrush-Fescue woodland understory site.

113D—Nagle silt loam, 12 to 35 percent north slopes. This deep, well drained soil is on the side slopes of dissected terraces. It formed in mixed alluvium influenced by volcanic ash and loess in the surface layer. Areas are irregular in shape and are 40 to 200 acres in size. The native vegetation is mainly bunchgrasses, shrubs, and forbs. Elevation is 3,000 to 4,500 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 42 to 45 degrees F, and the average frost-free period is 80 to 110 days.

Typically, the surface layer is very dark brown silt loam about 18 inches thick. The upper part of the subsoil is very dark grayish brown and dark brown silty clay loam about 16 inches thick. The lower part to a depth of 60 inches or more is brown gravelly silty clay loam.

Included in this unit are small areas of Encina soils and small areas of Nagle soils that have a surface layer of gravelly silt loam. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate to a depth of about 18 inches in the Nagle soil and moderately slow below that depth. Available water capacity is 8 to 11 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 mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on this unit is dominated by Idaho fescue and Wyoming big sagebrush.

Idaho fescue is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 1,700 pounds per acre in favorable years and 600 pounds per acre in unfavorable years.

If the condition of the site deteriorates through overgrazing, Idaho fescue loses vigor and decreases in extent. Sandberg bluegrass and Wyoming big sagebrush increase in extent. If deterioration continues, annual grasses and forbs invade the site.

The Nagle soil is in the Mountain North 9-12pz range site.

113E—Nagle silt loam, 35 to 50 percent north slopes. This deep, well drained soil is on the side slopes of dissected terraces. It formed in mixed alluvium influenced by volcanic ash and loess in the surface layer. Areas are irregular in shape and are 40 to 200 acres in size. The native vegetation is mainly bunchgrasses, shrubs, and forbs. Elevation is 3,000 to 4,500 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 42 to 45 degrees F, and the average frost-free period is 80 to 110 days.

Typically, the surface layer is very dark brown silt loam about 18 inches thick. The upper part of the subsoil is very dark grayish brown and dark brown silty clay loam about 16 inches thick. The lower part to a depth of 60 inches or more is brown gravelly silty clay loam.

Included in this unit are small areas of Encina soils and small areas of Nagle soils that have a surface layer of gravelly silt loam. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate to a depth of about 18 inches in the Nagle soil and moderately slow below that depth. Available water capacity is 8 to 11 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 mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on this unit is dominated by Idaho fescue and Wyoming big sagebrush.

Idaho fescue is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 1,700 pounds per acre in favorable years and 600 pounds per acre in unfavorable years. Livestock access is limited by the slope.

If the condition of the site deteriorates through overgrazing, Idaho fescue loses vigor and decreases in extent. Sandberg bluegrass and Wyoming big sagebrush increase in extent. If deterioration continues, annual grasses and forbs invade the site.

Mechanical treatment for brush control and range seeding is not practical because of the slope.

The Nagle soil is in the Mountain North 9-12pz range site.

114C—North Powder loam, 2 to 12 percent slopes. This moderately deep, well drained soil is on hills. It formed in colluvium derived from quartz diorite and other related granitic rocks. Areas are irregular in shape and are 40 to 400 acres in size. The native vegetation is mainly bunchgrasses, forbs, and shrubs. Elevation is 3,000 to 3,800 feet. The average annual precipitation is

9 to 14 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 110 to 130 days.

Typically, the surface layer is dark grayish brown loam about 8 inches thick. The next layer is dark brown loam about 4 inches thick. The upper 10 inches of the subsoil is dark brown clay loam. The lower part is dark brown, calcareous loam. It extends to a depth of about 28 inches. The depth to weathered bedrock is 20 to 40 inches.

Included in this unit are small areas of Baker and Keating soils and Rock outcrop. Also included are small areas of soils that are similar to the North Powder soil but are less than 20 inches deep over weathered bedrock. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate in the North Powder soil. Available water capacity is 4 to 6 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 mainly for livestock grazing. In some areas it is used for irrigated small grain or for hay and pasture. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on this unit is dominated by Idaho fescue, needleanddthread, and Wyoming big sagebrush.

Idaho fescue and needleandthread are the major forage-producing plants. If the site is in excellent condition, the total annual production is estimated at 1,500 pounds per acre in favorable years and 500 pounds per acre in unfavorable years.

If the condition of the site deteriorates through overgrazing, Idaho fescue loses vigor and decreases in extent. Needleandthread, Thurber needlegrass, Sandberg bluegrass, and Wyoming big sagebrush increase in extent. If deterioration continues, the extent of needlegrass decreases and cheatgrass and other annual grasses and forbs invade the site.

Hay and pasture or cropland.—If this unit is used for hay and pasture or small grain, the main limitation is the rooting depth.

Management that maintains the optimum vigor and quality of forage plants is needed. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and control erosion. Periodic mowing and clipping help to maintain uniform growth and prevent selective grazing.

Irrigation is needed for the maximum production of most crops. Irrigation water can be applied by the sprinkler method. Sprinkler irrigation permits the even, controlled application of water and helps to control runoff. To avoid 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.

Fertilizer is needed to ensure the optimum growth of grasses, legumes, and crops. Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain soil fertility and tilth.

Conducting fieldwork during wet periods results in deterioration of tilth and destroys soil structure. As a result, it increases the runoff rate and the hazard of erosion. Runoff and erosion can be controlled by crop residue management and by rough or minimum tillage. All tillage should be on the contour or across the slope.

Grazing during wet periods results in compaction of the surface layer, poor tilth, and excessive runoff. Compaction limits the movement of air and water in the soil and restricts the growth of roots.

The trees and shrubs grown as windbreaks and environmental plantings should be those that are tolerant of droughty conditions. A very low available water capacity may cause severe seedling mortality. Continued cultivation, mulching, or applications of herbicide to control competing vegetation are needed to ensure the establishment and survival of seedlings. Irrigation may be needed when the trees and shrubs are planted and during dry periods.

The North Powder soil is in the Mountain Loamy 9-12pz range site.

115D—North Powder loam, 12 to 35 percent north slopes. This moderately deep, well drained soil is on hills. It formed in colluvium derived from quartz diorite and other related granitic rocks. The native vegetation is mainly bunchgrasses, forbs, and shrubs. Elevation is 3,000 to 3,800 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 110 to 130 days.

Typically, the surface layer is dark grayish brown loam about 8 inches thick. The next layer is dark brown loam about 4 inches thick. The subsoil is dark brown clay loam about 10 inches thick. The substratum is dark brown loam about 6 inches thick. The depth to weathered bedrock is 20 to 40 inches.

Included in this unit are small areas of Keating, Ridley, and Baker soils. Also included are small areas of soils that are similar to the North Powder soil but are more than 40 inches deep over bedrock. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate in the North Powder soil. Available water capacity is 4 to 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 mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on this unit is dominated by Idaho fescue and Wyoming big sagebrush.

Idaho fescue is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 1,700 pounds per acre in favorable years and 600 pounds per acre in unfavorable years.

If the condition of the site deteriorates through overgrazing, Idaho fescue loses vigor and decreases in extent. Sandberg bluegrass and Wyoming big sagebrush increase in extent. If deterioration continues, annual grasses and forbs invade the site.

The North Powder soil is in the Mountain North 9-12pz range site.

116D—North Powder loam, 12 to 35 percent south slopes. This moderately deep, well drained soil is on hills. It formed in colluvium derived from quartz diorite and other related granitic rocks. Areas are irregular in shape and are 40 to 400 acres in size. The native vegetation is mainly bunchgrasses, forbs, and shrubs. Elevation is 3,000 to 3,800 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 110 to 130 days.

Typically, the surface layer is dark grayish brown loam about 8 inches thick. The next layer is dark brown loam about 4 inches thick. The subsoil is dark brown clay loam about 10 inches thick. The substratum is dark brown loam about 6 inches thick. The depth to weathered bedrock is 20 to 40 inches.

Included in this unit are small areas of Keating and Ruckles soils and Rock outcrop. Also included are small areas of soils that are similar to the North Powder soil but are less than 20 inches deep over weathered bedrock. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate in the North Powder soil. Available water capacity is 4 to 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 mainly for livistock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on this unit is dominated by bluebunch wheatgrass and Wyoming big sagebrush.

Bluebunch wheatgrass is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 1,200 pounds per acre in favorable years and 400 pounds per acre in unfavorable years.

If the condition of the site deteriorates through overgrazing, bluebunch wheatgrass and Thurber needlegrass lose vigor and decrease in extent. Sandberg bluegrass and Wyoming big sagebrush increase in extent. If deterioration continues, annual grasses and forbs invade the site.

The North Powder soil is in the Clayey South 9-12pz range site.

117D—North Powder-Rock outcrop complex, 12 to 35 percent south slopes. This map unit is on hills. Areas are irregular in shape and are 20 to 200 acres in size. The native vegetation is mainly bunchgrasses, forbs, and shrubs. Elevation is 3,000 to 3,800 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 110 to 130 days.

This unit is about 60 percent North Powder loam 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 selected scale.

Included in this unit are small areas of soils that are similar to the North Powder soil but are less than 20 inches deep over bedrock. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The North Powder soil is moderately deep and well drained. It formed in colluvium derived from quartz diorite and other related granitic rocks. Typically, the surface layer is dark grayish brown loam about 8 inches thick. The next layer is dark brown loam about 4 inches thick. The upper 10 inches of the subsoil is dark brown clay loam. The lower part is dark brown, calcareous loam. It extends to a depth of about 28 inches. The depth to weathered bedrock is 20 to 40 inches.

Permeability is moderate in the North Powder soil. Available water capacity is 4 to 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 mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on the North Powder soil is dominated by bluebunch wheatgrass and Wyoming big sagebrush.

Bluebunch wheatgrass is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 1,200 pounds per acre in favorable years and 400 pounds per acre in unfavorable years. Livestock access is limited by the Rock outcrop.

If the condition of the site deteriorates through overgrazing, bluebunch wheatgrass loses vigor and decreases in extent. Sandberg bluegrass and Wyoming big sagebrush increase in extent. If deterioration continues, annual grasses and forbs invade the site.

Mechanical treatment for brush control and range seeding is limited by the Rock outcrop.

The North Powder soil is in the Clayey South 9-12pz range site.

118C—Oxman silt loam, 2 to 12 percent slopes. This moderately deep, well drained soil is on dissected fan terraces. It formed in lacustrine sediments. Areas are irregular in shape and are 80 to 200 acres in size. The native vegetation is mainly bunchgrasses, forbs, and shrubs. Elevation is 2,600 to 3,500 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 110 to 130 days.

Typically, the surface layer is dark brown silt loam about 4 inches thick. The upper part of the subsoil is brown silt loam about 7 inches thick. The lower 18 inches is brown and dark yellowish brown silt loam. The depth to consolidated lacustrine sediments is 20 to 40 inches.

Included in this unit are small areas of Legler and Encina soils. Also included are small areas of soils that are similar to the Oxman soil but are more than 40 inches deep to lacustrine sediments. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate in the Oxman soil. Available water capacity is 4 to 7 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 mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on this unit is dominated by bluebunch wheatgrass, Thurber needlegrass, and Wyoming big sagebrush.

Bluebunch wheatgrass and Thurber needlegrass are the major forage-producing plants. If the site is in excellent condition, the total annual production is estimated at 1,500 pounds per acre in favorable years and 500 pounds per acre in unfavorable years.

If the condition of the site deteriorates through overgrazing, bluebunch wheatgrass and Thurber needlegrass lose vigor and decrease in extent. Sandberg bluegrass and Wyoming big sagebrush increase in extent. If deterioration continues, cheatgrass and other annual grasses and forbs strongly invade the site.

The Oxman soil is in the Loamy 9-12pz range site.

119D—Oxman silt loam, 12 to 35 percent south slopes. This moderately deep, well drained soil is on dissected fan terraces. It formed in lacustrine sediments. Areas are irregular in shape and are 80 to 200 acres in size. The native vegetation is mainly bunchgrasses, forbs, and shrubs. Elevation is 2,600 to 3,500 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 110 to 130 days.

Typically, the surface layer is dark brown silt loam about 4 inches thick. The upper part of the subsoil is brown silt loam about 7 inches thick. The lower 18 inches is brown and dark yellowish brown silt loam. The depth to consolidated lacustrine sediments is 20 to 40 inches.

Included in this unit are small areas of Encina soils and the steep Xeric Torriorthents. Also included are small areas of soils that are similar to the Oxman soil but are more than 40 inches deep to lacustrine sediments. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate in the Oxman soil. Available water capacity is 4 to 7 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 mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on this unit is dominated by bluebunch wheatgrass and Wyoming big sagebrush.

Bluebunch wheatgrass is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 1,200 pounds per acre in favorable years and 400 pounds per acre in unfavorable years.

If the condition of the site deteriorates through overgrazing, bluebunch wheatgrass loses vigor and decreases in extent. Sandberg bluegrass and Wyoming big sagebrush increase in extent. If deterioration continues, annual grasses and forbs invade the site.

The Oxman soil is in the Clayey South 9-12pz range site.

120D—Oxman-Xeric Torriorthents silt loams, 12 to 35 percent south slopes. This map unit is on the side slopes of dissected fan terraces. It formed in lacustrine sediments. Areas are irregular in shape and are 40 to 100 acres in size. The native vegetation is mainly bunchgrasses, forbs, and shrubs. Elevation is 2,600 to 3,500 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 45 to 50

degrees F, and the average frost-free period is 110 to 130 days.

This unit is about 50 percent Oxman silt loam and 35 percent Xeric Torriorthents. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of Encina soils. Also included are small areas of soils that are similar to the Oxman soil but are more than 40 inches deep to lacustrine sediments. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Oxman soil is moderately deep and well drained. It formed in lacustrine sediments. Typically, the surface layer is dark brown silt loam about 4 inches thick. The upper part of the subsoil is brown silt loam about 7 inches thick. The lower 18 inches is brown and dark yellowish brown silt loam. The depth to consolidated lacustrine sediments is 20 to 40 inches.

Permeability is moderate in the Oxman soil. Available water capacity is 4 to 7 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate or high.

The Xeric Torriorthents are very shallow or shallow and are well drained. They formed in lacustrine sediments. Typically, the surface layer is grayish brown silt loam about 3 inches thick. The substratum is grayish brown silt loam. It extends to a depth of about 7 inches. The depth to consolidated lacustrine sediments is 3 to 20 inches.

Permeability is moderate in the Xeric Torriorthents. Available water capacity is 0.5 inch to 3.0 inches. The effective rooting depth is 3 to 20 inches. Runoff is medium or rapid, and the hazard of water erosion is high.

This unit is used mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on the Oxman soil is dominated by bluebunch wheatgrass and Wyoming big sagebrush.

Bluebunch wheatgrass is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 1,200 pounds per acre in favorable years and 400 pounds per acre in unfavorable years.

The potential plant community on the Xeric Torriorthents is dominated by antelope bitterbrush, needleandthread, Thurber needlegrass, basin big sagebrush, and rabbitbrush.

Thurber needlegrass and needleandthread are the major forage-producing plants. If the site is in excellent condition, the total annual production is estimated at 1,000 pounds per acre in favorable years and 500 pounds per acre in unfavorable years.

If the condition of the site deteriorates through overgrazing, bluebunch wheatgrass, needlegrass, and antelope bitterbrush lose vigor and decrease in extent. Sandberg bluegrass and Wyoming big sagebrush increase in extent. If deterioration continues, annual grasses and forbs invade the site.

Brush control on the Xeric Torriorthents is not advisable because of the value of antelope bitterbrush for wildlife.

The Oxman soil is in the Clayey South 9-12pz range site. The Xeric Torriorthents are in the Terrace Escarpment 9-12pz range site.

121E—Piersonte very channery loam, 35 to 50 percent north slopes. This deep, well drained soil is on mountains. It formed in colluvium derived from schist. Areas are irregular in shape and are 80 to 400 acres in size. The native vegetation is mainly conifers, shrubs, and grasses. Elevation is 3,500 to 5,500 feet. The average annual precipitation is 20 to 30 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 30 to 60 days.

Typically, the surface is covered with a mat of partially decomposed needles, leaves, and twigs about 1 inch thick. The surface layer is black very channery loam about 15 inches thick. The upper 12 inches of the subsoil is black extremely channery loam. The lower 16 inches is very dark gray extremely channery clay loam. The substratum to a depth of 60 inches or more is dark grayish brown extremely channery sandy clay loam. The depth to bedrock is 60 inches or more.

Included in this unit are small areas of Brannan soils. Also included are small areas of Sisley soils on south-facing slopes and Chambeam and Sinker soils on north-facing slopes. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate in the Piersonte soil. Available water capacity is 3 to 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 mainly for timber production. It also is used for livestock grazing, and it provides habitat for many kinds of wildlife.

Woodland.—This unit is suited to the production of Douglas-fir and ponderosa pine. The mean site index is 62 for Douglas-fir (50-year base age) and 93 for ponderosa pine (100-year base age). The potential production at culmination of the mean annual increment for Douglas-fir is 47 cubic feet per acre per year (3.3 cubic meters per hectare per year) in a 109-year-old, even-aged, fully stocked stand and for ponderosa pine is 94 cubic feet per acre per year (6.6 cubic meters per hectare per year) in a 40-year-old, even-aged, fully stocked stand.

The main concerns in producing and harvesting timber are the hazard of erosion, the equipment limitation, seedling mortality, the hazard of windthrow, plant competition, and fire damage to the soil.

Minimizing the risk of erosion is essential in areas where timber is harvested. Properly designed road drainage systems that include carefully located culverts help to control erosion. Spoil from excavations is subject to rill and gully erosion and to sloughing. Roads, landings, skid trails, and firebreaks can be protected against erosion by constructing water bars and by seeding areas that have been cut and filled. Buffer strips may be needed in areas adjacent to perennial streams to minimize siltation and maintain stream temperatures.

The slope restricts the use of wheeled and tracked equipment. High-lead or other logging systems that fully or partially suspend the logs above the ground cause less damage to the soil than tractor systems and reduce the risk of compaction. The risk of compaction also can be reduced by using low-pressure ground equipment, laying out skid trails in advance, and harvesting timber when the soil is dry or frozen.

Careful management of reforestation is needed to minimize competition from undesirable plants. If the site is not adequately prepared, plant competition can prevent or delay the reestablishment of volunteer or planted trees. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying. Scarification is severely restricted in the steeper areas because of increased expense and soil displacement.

The seedling mortality rate is increased by compaction of the surface layer and by plant competition. The high content of rock fragments also limits seedling survival. To compensate for the higher mortality rate that is expected, larger seedlings or a greater number of seedlings than is typical can be planted. Trees suitable for planting are ponderosa pine and Douglas-fir.

Trees on the Piersonte soil are subject to windthrow during periods when the soil is excessively wet and winds are strong. Regeneration systems that isolate single trees or groups of trees are not practical because of the hazard of windthrow.

Some decline in forest productivity may result from fire of moderate intensity.

Grazable woodland.—This unit is suitable for use as grazable woodland. The understory consists mainly of low Oregongrape, elk sedge, myrtle pachystima, pinegrass, heartleaf arnica, and princes pine.

A system that results in proper grazing use is essential if livestock graze this unit. Timely deferment of grazing is needed to allow the desirable plants to mature and set seed. Grazing should be delayed in spring until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.

This soil can produce adequate forage for big game animals after the tree canopy is opened by logging, fire, or some other disturbance. Dense stands of timber should be left in some areas to provide escape and thermal cover for the big game animals.

The Piersonte soil is in the Fir-Pine-Sedge woodland understory site.

121F—Piersonte very channery loam, 50 to 70 percent north slopes. This deep, well drained soil is on mountains. It formed in colluvium derived from schist. Areas are irregular in shape and are 80 to 400 acres in size. The native vegetation is mainly conifers, shrubs, and grasses. Elevation is 3,500 to 5,500 feet. The average annual precipitation is 20 to 30 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 30 to 60 days.

Typically, the surface is covered with a mat of partially decomposed needles, leaves, and twigs about 1 inch thick. The surface layer is black very channery loam about 15 inches thick. The upper 12 inches of the subsoil is black extremely channery loam. The lower 16 inches is very dark gray extremely channery clay loam. The substratum to a depth of 60 inches or more is dark grayish brown extremely channery sandy clay loam. The depth to bedrock is 60 inches or more.

Included in this unit are small areas of Brannan soils. Also included are small areas of Sisley soils on south-facing slopes and Chambeam and Sinker soils on north-facing slopes. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate in the Piersonte soil. Available water capacity is 3 to 6 inches. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is very high.

This unit is used mainly for timber production. It also provides habitat for many kinds of wildlife.

Woodland.—This unit is suited to the production of Douglas-fir and ponderosa pine. The mean site index is 62 for Douglas-fir (50-year base age) and 93 for ponderosa pine (100-year base age). The potential production at culmination of the mean annual increment for Douglas-fir is 47 cubic feet per acre per year (3.3 cubic meters per hectare per year) in a 109-year-old, even-aged, fully stocked stand and for ponderosa pine is 94 cubic feet per acre per year (6.6 cubic meters per hectare per year) in a 40-year-old, even-aged, fully stocked stand.

The main concerns in producing and harvesting timber are the hazard of erosion, the equipment limitation, seedling mortality, the hazard of windthrow, plant competition, and fire damage to the soil.

Minimizing the risk of erosion is essential in areas where timber is harvested. Properly designed road drainage systems that include carefully located culverts help to control erosion. Spoil from excavations is subject to rill and gully erosion and to sloughing. Roads, landings, skid trails, and firebreaks can be protected against erosion by constructing water bars and by seeding areas that have been cut and filled. Buffer strips may be needed in areas adjacent to perennial streams to minimize siltation and maintain stream temperatures.

The slope prevents the use of wheeled and tracked equipment. High-lead or other logging systems that fully suspend the logs above the ground cause less damage to the soil than other systems. The risk of compaction can be reduced by using suitable harvesting methods and by harvesting when the soil is dry or frozen.

Careful management of reforestation is needed to minimize competition from undesirable plants. If the site is not adequately prepared, plant competition can prevent or delay the reestablishment of volunteer or planted trees. Competing weeds, brush, or trees can be controlled by spraying, cutting, or girdling.

The high content of rock fragments limits seedling survival. To compensate for the higher expected mortality rate, larger seedlings or a greater number of seedlings than is typical can be planted. Trees suitable for planting are ponderosa pine and Douglas-fir.

Trees on the Piersonte soil are subject to windthrow during periods when the soil is excessively wet and winds are strong. Regeneration systems that isolate single trees or groups of trees are not practical because of the hazard of windthrow.

Some decline in forest productivity may result from fire of moderate intensity.

The understory consists mainly of low Oregongrape, elk sedge, myrtle pachystima, pinegrass, heartleaf arnica, and princes pine.

This soil can produce adequate forage for big game animals after the tree canopy is opened by logging, fire, or some other disturbance. Dense stands of timber should be left in some areas to provide escape and thermal cover for the big game animals.

The Piersonte soil is in the Fir-Pine-Sedge woodland understory site.

122C—Poall very fine sandy loam, 2 to 12 percent slopes. This deep, well drained soil is on hills. It formed in lacustrine sediments. Areas are long and rectangular and are 80 to 400 acres in size. The native vegetation is mainly bunchgrasses, forbs, and shrubs. Elevation is 2,200 to 3,600 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 48 to 52 degrees F, and the average frost-free period is 110 to 140 days.

Typically, the surface layer is dark brown very fine sandy loam about 9 inches thick. The upper part of the subsoil is about 16 inches of dark brown clay and silty clay loam. The lower part to a depth of about 60 inches is dark yellowish brown very fine sandy loam. The depth to consolidated lacustrine sediments is typically 60 inches or more but is 40 to 60 inches in some areas.

Included in this unit are small areas of Encina and Oxman soils. Also included are small areas of Poall soils that have a surface layer of loamy fine sand. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate to a depth of about 9 inches in the Poall soil and slow below that depth. Available water capacity is 8 to 11 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 livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on this unit is dominated by bluebunch wheatgrass, Thurber needlegrass, and Wyoming big sagebrush.

Bluebunch wheatgrass and Thurber needlegrass are the major forage-producing plants. If the site is in excellent condition, the total annual production is estimated at 1,500 pounds per acre in favorable years and 500 pounds per acre in unfavorable years.

If the condition of the site deteriorates through overgrazing, bluebunch wheatgrass and Thurber needlegrass lose vigor and decrease in extent. Sandberg bluegrass and Wyoming big sagebrush increase in extent. If deterioration continues, cheatgrass and other annual grasses and forbs invade the site.

The Poall soil is in the Loamy 9-12pz range site.

123D—Poall very fine sandy loam, 12 to 40 percent north slopes. This deep, well drained soil is on hills. It formed in lacustrine sediments. Areas are long and rectangular and are 80 to 400 acres in size. The native vegetation is mainly bunchgrasses, forbs, and shrubs. Elevation is 2,200 to 3,600 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 48 to 52 degrees F, and the average frost-free period is 110 to 140 days.

Typically, the surface layer is dark brown very fine sandy loam about 9 inches thick. The upper part of the subsoil is about 16 inches of dark brown clay and silty clay loam. The lower part to a depth of about 60 inches is dark yellowish brown very fine sandy loam. The depth to consolidated lacustrine sediments is typically 60 inches or more but is 40 to 60 inches in some areas.

Included in this unit are small areas of Encina soils. Also included are small areas of Poall soils that have a surface layer of loamy fine sand. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate to a depth of about 9 inches in the Poall soil and slow below that depth. Available water capacity is 8 to 11 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 mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on this unit is dominated by Idaho fescue, bluebunch wheatgrass, and Wyoming big sagebrush.

Idaho fescue and bluebunch wheatgrass are the major forage-producing plants. If the site is in excellent condition, the total annual production is estimated at 1,700 pounds per acre in favorable years and 600 pounds per acre in unfavorable years.

If the condition of the site deteriorates through overgrazing, Idaho fescue loses vigor and decreases in extent. Bluebunch wheatgrass, Sandberg bluegrass, and big sagebrush increase in extent. If deterioration continues, the extent of bluebunch wheatgrass decreases and cheatgrass and other annual plants invade the site.

The Poall soil is in the North 9-12pz range site.

124D—Poall very fine sandy loam, 12 to 40 percent south slopes. This deep, well drained soil is on hills. It formed in lacustrine sediments. Areas are long and rectangular and are 80 to 400 acres in size. The native vegetation is mainly bunchgrasses, forbs, and shrubs. Elevation is 2,200 to 3,600 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 48 to 52 degrees F, and the average frost-free period is 110 to 140 days.

Typically, the surface layer is dark brown very fine sandy loam about 9 inches thick. The upper part of the subsoil is about 16 inches of dark brown clay and silty clay loam. The lower part to a depth of about 60 inches is dark yellowish brown very fine sandy loam. The depth to consolidated lacustrine sediments is typically 60 inches or more but is 40 to 60 inches in some areas.

Included in this unit are small areas of Encina and Oxman soils and Xeric Torriorthents. Also included are small areas of soils that are similar to the Poall soil but are less than 40 inches deep to lacustrine sediments. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate to a depth of about 9 inches in the Poall soil and slow below that depth. Available water capacity is 8 to 11 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 mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on this unit is dominated by bluebunch wheatgrass and Wyoming big sagebrush.

Bluebunch wheatgrass is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 1,200 pounds per acre in favorable years and 400 pounds per acre in unfavorable years.

If the condition of the site deteriorates through overgrazing, bluebunch wheatgrass loses vigor and decreases in extent. Sandberg bluegrass and Wyoming big sagebrush increase in extent. If deterioration continues, annual grasses and forbs invade the site.

The Poall soil is in the Clayey South 9-12pz range site.

125D—Poall-Xeric Torriorthents complex, 12 to 40 percent south slopes. This map unit is on the side slopes of hills. It formed in lacustrine sediments. Areas are long and rectangular and are 80 to 200 acres in size. The native vegetation is mainly bunchgrasses, forbs, and shrubs. Elevation is 2,200 to 3,600 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 48 to 52 degrees F, and the average frost-free period is 110 to 140 days.

This unit is about 50 percent Poall very fine sandy loam and 35 percent Xeric Torriorthents. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of Oxman and Encina soils. Also included are small areas of soils that are similar to the Poall soil but are less than 40 inches deep to consolidated lacustrine sediments. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Poall soil is deep and well drained. It formed in lacustrine sediments. Typically, the surface layer is dark brown very fine sandy loam about 9 inches thick. The upper part of the subsoil is 16 inches of dark brown clay and silty clay loam. The lower part to a depth of about 60 inches is dark yellowish brown very fine sandy loam. The depth to consolidated lacustrine sediments is typically 60 inches or more but is 40 to 60 inches in some areas.

Permeability is moderate to a depth of about 9 inches in the Poall soil and slow below that depth. Available water capacity is 8 to 11 inches. The effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate or high.

The Xeric Torriorthents are very shallow or shallow and are well drained. They formed in lacustrine sediments. Typically, the surface layer is grayish brown silt loam about 3 inches thick. The substratum is grayish brown silt loam. It extends to a depth of about 7 inches. The depth to consolidated lacustrine sediments is 3 to 20 inches.

Permeability is moderate in the Xeric Torriorthents. Available water capacity is 0.5 inch to 3.0 inches. The effective rooting depth is 3 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. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on the Poall soil is dominated by bluebunch wheatgrass and Wyoming big sagebrush.

Bluebunch wheatgrass is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 1,200 pounds per acre in favorable years and 400 pounds per acre in unfavorable years.

The potential plant community on the Xeric Torriorthents is dominated by antelope bitterbrush, needleandthread, basin big sagebrush, and rabbitbrush.

Thurber needlegrass and needleandthread are the major forage-producing plants. If the site is in excellent condition, the total annual production is estimated at 1,000 pounds per acre in favorable years and 500 pounds per acre in unfavorable years.

If the condition of the site deteriorates through overgrazing, bluebunch wheatgrass, needlegrass, and antelope bitterbrush lose vigor and decrease in extent. Sandberg bluegrass and Wyoming big sagebrush increase in extent. If deterioration continues, annual grasses and forbs invade the site.

Brush control on the Xeric Torriorthents is not advisable because of the value of antelope bitterbrush for wildlife.

The Poall soil is in the Clayey South 9-12pz range site. The Xeric Torriorthents are in the Terrace Escarpment 9-12pz range site.

126A—Powval silt loam, 0 to 3 percent slopes. This deep, well drained soil is on low terraces. It formed in mixed alluvium influenced by volcanic ash. Areas are irregular in shape and are 20 to 80 acres in size. The vegetation in areas that have not been cultivated is mainly bunchgrasses and forbs. Elevation is 2,600 to 3,500 feet. The average annual precipitation is about 9 to 12 inches, the average annual air temperature is 45 to 47 degrees F, and the average frost-free period is 110 to 125 days.

Typically, the surface layer is very dark grayish brown silt loam about 13 inches thick. The upper part of the subsoil is dark brown silt loam about 19 inches thick. The lower part to a depth of 60 inches or more is very dark grayish brown silt loam.

Included in this unit are small areas of Jett and Wingville soils. Also included are small areas of Baker and Goodrich soils. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate in the Powval soil. Available water capacity is 10 to 14 inches. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. A seasonal high water table fluctuates between depths of 4 and 6 feet during the spring of the year.

This unit is used mainly for irrigated small grain, potatoes, hay, and pasture. It also is used for homesites, and it provides habitat for many kinds of wildlife.

Hay and pasture or cropland.—This unit is well suited to irrigated hay, pasture, and crops. It has few limitations.

Fertilizer is needed to ensure the optimum growth of grasses, legumes, and crops. Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain soil fertility and tilth.

In summer irrigation is needed for the maximum production of most crops. Irrigation water can be applied by the controlled surface and sprinkler methods. Sprinkler irrigation permits the even, controlled application of water and helps to control runoff. Leveling helps to ensure the uniform application of water (fig. 9). To avoid 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.

Management that maintains the optimum vigor and quality of forage plants is needed. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and control erosion. Periodic mowing and clipping help to maintain uniform growth and prevent selective grazing.

Maintaining crop residue on or near the surface can help to control runoff and soil blowing and maintain tilth and the organic matter content. Conducting fieldwork during wet periods results in deterioration of tilth and destroys soil structure. As a result, it increases the runoff rate and the hazard of erosion. Compaction limits the movement of air and water in the soil and restricts the growth of roots. Excessive cultivation can result in

Figure 9.—Land leveling on Powval silt loam, 0 to 3 percent slopes.

the formation of a tillage pan. This pan can be broken by subsoiling when the soil is dry.

The trees and shrubs grown as windbreaks and environmental plantings should be those that are tolerant of a high content of lime. The free carbonates in the soil tie up minerals and limit their availability. Cultivation or applications of herbicide help to remove competing vegetation.

Homesite development.—If this unit is used for homesite development, the main limitations are the potential for frost action, moderate wetness, and the restricted permeability.

Properly designing foundations, footings, and roads helps to offset the potential for frost action. Local roads and streets may require a special base to prevent the damage caused by frost heaving.

Septic tank absorption fields may function poorly because of wetness late in winter and in spring. If the Powval soil is used for septic tank absorption fields, the moderate permeability can be overcome by increasing the size of the absorption fields.

In summer irrigation is needed in areas used for lawns, shrubs, vines, or trees.

The Powval soil is in the Loamy Bottom range site.

127A—Powval silt loam, 0 to 3 percent slopes, warm. This deep, well drained soil is on low terraces. It formed in mixed alluvium high in volcanic ash. Areas are irregular in shape and are 20 to 100 acres in size. The vegetation in areas that have not been cultivated is mainly bunchgrasses, forbs, and shrubs. Elevation is 2,200 to 2,600 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 47 to 49 degrees F, and the average frost-free period is 125 to 140 days.

Typically, the surface layer is very dark grayish brown silt loam about 13 inches thick. The upper part of the subsoil is dark brown silt loam about 19 inches thick. The lower part to a depth of 60 inches or more is dark grayish brown silt loam.

Included in this unit are small areas of Jett and Wingville soils. Also included are small areas of Baker, warm soils. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate in the Powval soil. Available water capacity is 10 to 14 inches. The effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. A seasonal high water table fluctuates between depths of 4 and 6 feet during the spring of the year.

This unit is used mainly for irrigated crops, hay, and pasture. It also is used for homesite development, and it provides habitat for many kinds of wildlife.

Hay and pasture or cropland.—This unit is well suited to irrigated hay, pasture, and many crops and has few limitations for those uses. The main crops grown on this unit are winter wheat, barley, field corn, alfalfa, and grass-legume hay.

Fertilizer is needed to ensure the optimum growth of grasses, legumes, and crops. Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, and grass-legume mixtures help to maintain soil fertility and tilth.

In summer irrigation is needed for the maximum production of most crops. Irrigation water can be applied by the controlled surface and sprinkler methods. Sprinkler irrigation permits the even, controlled application of water and helps to control runoff. Leveling helps to ensure the uniform application of water. To avoid 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.

Management that maintains the optimum vigor and quality of forage plants is needed. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and control erosion. Periodic mowing and clipping help to maintain uniform growth and prevent selective grazing.

Maintaining crop residue on or near the surface can help to control runoff and soil blowing and maintain tilth and the organic matter content. Conducting fieldwork during wet periods results in deterioration of tilth and destroys soil structure. As a result, it increases the runoff rate and the hazard of erosion. Compaction limits the movement of air and water in the soil and restricts the growth of roots. Excessive cultivation can result in the formation of a tillage pan. This pan can be broken by subsoiling when the soil is dry.

The trees and shrubs grown as windbreaks and environmental plantings should be those that are tolerant of a high content of lime. The free carbonates in the soil tie up minerals and limit their availability. Cultivation or applications of herbicide help to remove competing vegetation.

Homesite development.—If this unit is used for homesite development, the main limitations are the potential for frost action and wetness.

Properly designing foundations, footings, and roads helps to offset the potential for frost action. Local roads and streets may require a special base to prevent the damage caused by frost heaving.

Septic tank absorption fields may function poorly because of wetness in winter and spring. If the Powval soil is used for septic tank absorption fields, the moderate permeability can be overcome by increasing the size of the absorption fields.

In summer irrigation is needed in areas used for lawns, shrubs, vines, or trees.

The Powval soil is in the Loamy Bottom range site.

128B—Pritchard silty clay loam, 2 to 7 percent slopes. This deep, well drained soil is on hills. It formed in loess and in colluvium derived from gabbro. Areas are irregular in shape and are 20 to 200 acres in size. The native vegetation is mainly bunchgrasses, forbs, and shrubs. Elevation is 3,200 to 3,700 feet. The average annual precipitation is 12 to 16 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 110 to 130 days.

Typically, the surface layer is very dark gray silty clay loam about 12 inches thick. The upper 16 inches of the subsoil is very dark grayish brown clay. The lower 24 inches is dark brown and dark yellowish brown silty clay. The substratum to a depth of 60 inches or more is yellowish brown clay loam.

Included in this unit are small areas of Hibbard and Virtue soils. Also included are small areas of Pritchard soils that have cobbles on the surface. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderately slow to a depth of about 12 inches in the Pritchard soil and slow below that depth. Available water capacity is 6 to 9 inches. The effective rooting depth is limited by the dense clay subsoil at a depth of 10 to 20 inches. Runoff is slow, and the hazard of water erosion is slight.

This unit is used mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on this unit is dominated by Idaho fescue and mountain big sagebrush.

Idaho fescue is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 2,000 pounds per acre in favorable years and 1,000 pounds per acre in unfavorable years.

If the condition of the site deteriorates through overgrazing, Idaho fescue loses vigor and decreases in extent. Mountain big sagebrush, basin big sagebrush, bluebunch wheatgrass, and Sandberg bluegrass increase in extent. If deterioration continues, the extent of bluebunch wheatgrass decreases, the extent of big sagebrush strongly increases, and unpalatable forbs and annuals invade the site.

The Pritchard soil is in the Mountain Clayey 12-16pz range site.

129B—Rastus very gravelly loam, 1 to 7 percent slopes. This well drained soil is on terraces. It is moderately deep to a duripan. It formed in mixed alluvium. Areas are irregular in shape and are 80 to 200 acres in size. The native vegetation is mainly bunchgrasses, forbs, and shrubs. Elevation is 4,000 to 4,700 feet. The average annual precipitation is 12 to 16 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 60 to 90 days.

Typically, the surface layer is very dark grayish brown very gravelly loam about 4 inches thick. The next layer is very dark grayish brown gravelly clay loam about 8 inches thick. The upper part of the subsoil is dark yellowish brown clay about 7 inches thick. The next part is dark yellowish brown gravelly clay about 5 inches thick. The lower part is a brownish yellow, massive duripan about 13 inches thick. The substratum to a depth of 60 inches or more is multicolored extremely gravelly sandy loam. The depth to a duripan is 20 to 30 inches.

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

Permeability is slow above the duripan in the Rastus soil. Available water capacity is 3 to 5 inches. The effective rooting depth is 20 to 30 inches. Runoff is slow, and the hazard of water erosion is slight or moderate.

This unit is used mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on this unit is dominated by Idaho fescue and mountain big sagebrush.

Idaho fescue is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 2,000 pounds per acre in favorable years and 1,000 pounds per acre in unfavorable years.

If the condition of the site deteriorates through overgrazing, Idaho fescue loses vigor and decreases in extent. Big sagebrush, bluebunch wheatgrass, and Sandberg bluegrass increase in extent. If deterioration continues, the extent of bluebunch wheatgrass decreases, the extent of big sagebrush strongly increases, and annual grasses and forbs invade the site.

The Rastus soil is in the Mountain Clayey 12-16pz range site.

130E—Redcliff gravelly loam, 30 to 50 percent north slopes. This moderately deep, well drained soil is on hills. It formed in colluvium derived from metavolcanic rocks. Areas are irregular in shape and are 100 to 400 acres in size. The native vegetation is mainly bunchgrasses, forbs, and shrubs. Elevation is 2,000 to 3,600 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 46 to 48 degrees F, and the average frost-free period is 90 to 120 days.

Typically, the surface layer is very dark grayish brown gravelly loam about 8 inches thick. The subsoil is dark brown gravelly sandy clay loam about 14 inches thick. The substratum is dark yellowish brown very gravelly sandy loam. It extends to a depth of about 31 inches. The depth to bedrock is 20 to 40 inches.

Included in this unit are small areas of Lickskillet, Ruckles, and Ruclick soils. Also included are small areas of Rock outcrop and soils that are similar to the Redcliff soil but are more than 40 inches deep over bedrock. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate in the Redcliff soil. Available water capacity is 2 to 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 mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on this unit is dominated by Idaho fescue, bluebunch wheatgrass, and Wyoming big sagebrush

Idaho fescue and bluebunch wheatgrass are the major forage-producing plants. If the site is in excellent condition, the total annual production is estimated at 1,700 pounds per acre in favorable years and 600 pounds per acre in unfavorable years. Livestock access is limited by the slope.

If the condition of the site deteriorates through overgrazing, Idaho fescue loses vigor and decreases in extent. Bluebunch wheatgrass, Sandberg bluegrass, and big sagebrush increase in extent. If deterioration continues, the extent of bluebunch wheatgrass decreases and cheatgrass and other annual plants invade the site.

Mechanical treatment for brush control and range seeding is not practical because of the slope.

The Redcliff soil is in the North 9-12pz range site.

130F—Redcliff gravelly loam, 50 to 75 percent north slopes. This moderately deep, well drained soil is on hills. It formed in colluvium derived from metavolcanic rocks. Areas are irregular in shape and are 100 to 400 acres in size. The native vegetation is mainly bunchgrasses, forbs, and shrubs. Elevation is 2,000 to 3,600 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 46 to 48 degrees F, and the average frost-free period is 90 to 120 days.

Typically, the surface layer is very dark grayish brown gravelly loam about 8 inches thick. The subsoil is dark brown gravelly sandy clay loam about 14 inches thick. The substratum is dark yellowish brown very gravelly sandy loam. It extends to a depth of about 31 inches. The depth to bedrock is 20 to 40 inches.

Included in this unit are small areas of Lickskillet, Ruckles, and Ruclick soils. Also included are small areas of Rock outcrop. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate in the Redcliff soil. Available water capacity is 2 to 5 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is very high.

This unit is used mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on this unit is dominated by Idaho fescue, bluebunch wheatgrass, and Wyoming big sagebrush.

Idaho fescue and bluebunch wheatgrass are the major forage-producing plants. If the site is in excellent condition, the total annual production is estimated at 1,700 pounds per acre in favorable years and 600 pounds per acre in unfavorable years. Livestock access is limited by the slope.

If the condition of the site deteriorates through overgrazing, Idaho fescue loses vigor and decreases in extent. Bluebunch wheatgrass, Sandberg bluegrass, and big sagebrush increase in extent. If deterioration continues, the extent of bluebunch wheatgrass decreases and cheatgrass and other annual plants invade the site.

Mechanical treatment for brush control and range seeding is not practical because of the slope.

The Redcliff soil is in the North 9-12pz range site.

131C—Ridley-Keating silt loams, 2 to 12 percent slopes. This map unit is on hills. Areas are irregular in shape and are 80 to 200 acres in size. The native vegetation is mainly bunchgrasses, forbs, and shrubs. Elevation is 3,000 to 3,800 feet. The average annual precipitation is 12 to 16 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 130 days.

This unit is about 50 percent Ridley silt loam and 40 percent Keating silt loam. The Ridley soil is in concave areas, and the Keating soil is in convex areas. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of Clovercreek soils. Also included are small areas of Ridley soils that are 40 to 60 inches deep to bedrock. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

The Ridley soil is deep and well drained. It formed in colluvium derived from greenstone and influenced by loess and volcanic ash in the surface layer. Typically, the surface layer is very dark brown silt loam about 9 inches thick. The upper 15 inches of the subsoil is dark brown silty clay loam. The lower 18 inches is dark brown clay and silty clay. Below this to a depth of 60 inches or more is dark brown silty clay loam.

Permeability in the Ridley soil is moderately slow to a depth of about 24 inches and slow below that depth. Available water capacity is 4 to 8 inches. The effective rooting depth is limited by a dense clayey subsoil at a depth of 20 to 40 inches. Runoff is slow or medium, and the hazard of water erosion is slight or moderate.

The Keating soil is moderately deep and well drained. It formed in colluvium derived from greenstone and influenced by loess and volcanic ash in the surface layer. Typically, the surface layer is very dark brown silt loam about 8 inches thick. The upper 9 inches of the subsoil is dark brown clay loam. The lower 5 inches is dark yellowish brown clay. The depth to bedrock is 20 to 40 inches.

Permeability in the Keating soil is moderate to a depth of about 17 inches and slow below that depth. Available water capacity is 3 to 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 mainly for irrigated hay and pasture or small grain. It also is used for livestock grazing, and it provides habitat for many kinds of wildlife.

Hay and pasture or cropland.—The Ridley soil is well suited to hay and pasture to small grain. It has few limitations. The Keating soil is somewhat limited by the rooting depth and the slope.

Fertilizer is needed to ensure the optimum growth of grasses, legumes, and crops. Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain soil fertility and tilth.

In summer irrigation is needed for the maximum production of most crops. To avoid 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.

Management that maintains the optimum vigor and quality of forage plants is needed. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and control erosion. Periodic mowing and clipping help to maintain uniform growth and prevent selective grazing.

Conducting fieldwork during wet periods results in deterioration of tilth and destroys soil structure. As a result, it increases the runoff rate and the hazard of erosion. Runoff and erosion can be controlled by crop residue management and by rough or minimum tillage. All tillage should be on the contour or across the slope.

Grazing during wet periods results in compaction of the surface layer, poor tilth, and excessive runoff. Compaction limits the movement of air and water in the soil and restricts the growth of roots.

A wide variety of trees and shrubs can be grown as windbreaks and environmental plantings on the Ridley soil. Cultivation or applications of herbicide help to remove competing vegetation.

The Keating soil is generally unsuited to the trees and shrubs grown as windbreaks and environmental plantings. Onsite investigation is needed to identify areas where trees and shrubs can be planted if special management is applied.

Livestock grazing.—The potential plant community on the Ridley soil is dominated by Idaho fescue and mountain big sagebrush.

Idaho fescue is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 2,000 pounds per acre in favorable years and 1,000 pounds per acre in unfavorable years.

The potential plant community on the Keating soil is dominated by Idaho fescue and mountain big sagebrush.

Idaho fescue is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 1,800 pounds per acre in favorable years and 1,000 pounds per acre in unfavorable years.

If the condition of the site deteriorates through overgrazing, Idaho fescue loses vigor and decreases in extent. Big sagebrush, bluebunch wheatgrass, and Sandberg bluegrass increase in extent. If deterioration continues, the extent of bluebunch wheatgrass decreases, the extent of big sagebrush strongly increases, and annuals invade the site.

The Ridley soil is in the Mountain Clayey 12-16pz range site. The Keating soil is in the Mountain Loamy 12-16pz range site.

132A—Riverwash, 0 to 2 percent slopes. This deep, excessively drained to poorly drained miscellaneous area occurs as islands in major rivers and streams or as gravel and sand bars in and along major rivers and streams. It formed in recently deposited sand and gravel that does not have a vegetative cover. Areas are elongated and are 10 to 80 acres in size. Elevation is 1,800 to 4,000 feet. The average annual precipitation is 10 to 20 inches, the average annual air temperature is about 45 to 50 degrees F, and the average frost-free period is 90 to 140 days.

Typical pedon of the Riverwash unit is too variable to describe in detail, but it is dominated by stratified sand and gravel. It may contain large amounts of cobbles and stones.

Included in this unit are small areas of Baldock, Boyce, Balm, and Wingdale soils. Also included are small areas of Cumulic Haploxerolls. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is very rapid in the Riverwash. Available water capacity varies considerably. Runoff is slow, and the hazard of water erosion is very high because of overflow. A seasonal high water table fluctuates between depths of 0 and 2 feet in winter. This soil is frequently flooded for long periods in winter and summer.

This unit is generally not used because of the hazard of flooding, but it is occasionally used as a source of sand and gravel and it provides habitat for many kinds of wildlife.

Removal of sand and gravel may adversely affect stream channel hydraulics.

133C—Robinette-Gwinly complex, 2 to 12 percent slopes. This map unit is on hills, in areas known as biscuit-scablands. The areas are irregular in shape and are 20 to 200 acres in size. The native vegetation is mainly bunchgrasses, forbs, and shrubs. Elevation is 2,500 to 4,000 feet. The average annual precipitation is 14 to 20 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 120 days.

This unit is about 45 percent Robinette silt loam and 40 percent Gwinly very cobbly silt loam. The Robinette soil is in the biscuit, or mound part, of the unit, and the Gwinly soil is in the scabland, or intermound areas. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of Rockly and Immig soils. Also included are small areas of soils that are similar to the Robinette soil but are less than 40 inches deep over bedrock. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Robinette soil is deep and well drained. It formed in colluvium derived from basalt and influenced by loess in the surface layer. Typically, the surface layer is very dark brown silt loam about 13 inches thick. The upper 31 inches of the subsoil is dark brown silty clay loam. The lower 9 inches is brown extremely cobbly clay. The depth to bedrock is 40 to 60 inches.

Permeability is moderate to a depth of about 44 inches in the Robinette soil and slow below that depth. Available water capacity is 8 to 11 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.

The Gwinly soil is shallow and well drained. It formed in colluvium derived from basalt and influenced by volcanic ash and loess in the surface layer. Typically, the surface layer is very dark brown very cobbly silt loam about 3 inches thick. The upper 5 inches of the subsoil is very dark brown very cobbly silty clay loam. The lower 9 inches is dark brown extremely cobbly clay. The depth to bedrock is 10 to 20 inches.

Permeability is slow in the Gwinly soil. Available water capacity is 1 to 2 inches. The effective rooting depth is 10 to 20 inches. Runoff is slow or medium, and the hazard of water erosion is slight or moderate.

This unit is used mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on the Robinette soil is dominated by Idaho fescue and bluebunch wheatgrass.

Idaho fescue and bluebunch wheatgrass are the major forage-producing plants. If the site is in excellent condition, the total annual production is estimated at 2,000 pounds per acre in favorable years and 1,100 pounds per acre in unfavorable years.

The potential plant community on the Gwinly soil is dominated by Idaho fescue and bluebunch wheatgrass.

Idaho fescue and bluebunch wheatgrass are the major forage-producing plants. If the site is in excellent condition, the total annual production is estimated at 900 pounds per acre in favorable years and 300 pounds per acre in unfavorable years. Livestock access is limited by the very cobbly surface of the Gwinly soil.

If the condition of the site deteriorates through overgrazing, Idaho fescue and bluebunch wheatgrass lose vigor and decrease in extent. Sandberg bluegrass increases in extent, and other bluegrasses invade the site. If deterioration continues, cheatgrass and other annuals strongly invade the site.

Mechanical treatment for brush control and range seeding is not practical because of the very cobbly surface layer of the Gwinly soil.

The Robinette soil is in the Loamy 14-17pz range site. The Gwinly soil is in the Shallow Clayey 14-17pz range site.

134F—Rock outcrop-Lostbasin-Xerorthents complex, 50 to 80 percent south slopes. This map unit is on hills. Areas are irregular in shape and are 80 to 400 acres in size. The native vegetation is mainly bunchgrasses, forbs, and shrubs. Elevation is 4,000 to 5,300 feet. The average annual precipitation is 12 to 16 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 70 to 100 days.

This unit is about 40 percent Rock outcrop, 30 percent Lostbasin very channery loam, and 20 percent Xerorthents. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of soils that are similar to the Lostbasin soil but are less than 20 inches deep over bedrock. Included soils make up about 10 percent of the total acreage. The percentage varies from one area to another.

The Lostbasin soil is moderately deep and well drained. It formed in colluvium derived from schist and graywacke. Typically, the surface layer is dark grayish brown very channery loam about 5 inches thick. The upper part of the subsoil is brown extremely channery clay loam about 8 inches thick. The lower part is dark yellowish brown extremely channery clay loam about 15 inches thick. The depth to bedrock is 20 to 40 inches.

Permeability is moderate in the Lostbasin soil. Available water capacity is 1 to 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is very high.

The Xerorthents are very shallow to deep and are well drained or somewhat excessively drained. They formed in colluvium and residuum derived from schist. Typically, the surface layer is grayish brown extremely channery loam about 14 inches thick. The subsoil is yellowish brown extremely channery loam. It extends to a depth of about 29 inches. The depth to fractured bedrock is 5 to more than 60 inches.

Permeability is moderate or moderately rapid in the Xerorthents. Available water capacity is 1 to 8 inches.

The effective rooting depth is 5 to more than 60 inches. Runoff is rapid, and the hazard of water erosion is very high.

This unit is used mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on the Lostbasin soil is dominated by bluebunch wheatgrass, Idaho fescue, mountain big sagebrush, and squaw apple.

Bluebunch wheatgrass and Idaho fescue are the major forage-producing plants. If the site is in excellent condition, the total annual production is estimated at 1,400 pounds per acre in favorable years and 700 pounds per acre in unfavorable years. Livestock access is limited by the slope and the Rock outcrop.

The potential plant community on the Xerorthents is dominated by curlleaf mountainmahogany, bluebunch wheatgrass, western juniper, and bitterbrush.

Bluebunch wheatgrass is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 1,300 pounds per acre in favorable years and 600 pounds per acre in unfavorable years. Livestock access is limited by the slope and the Rock outcrop.

If the condition of the site deteriorates through overgrazing, bluebunch wheatgrass, Idaho fescue, curlleaf mountainmahogany, and antelope bitterbrush lose vigor and decrease in extent. Western juniper, big sagebrush, and Sandberg bluegrass increase in extent. If deterioration continues, annual grasses and forbs invade the site.

Brush control is not advisable because of the value of palatable shrubs in this unit for wildlife.

The Lostbasin soil is in the Mountain South 12-16pz range site. The Xerorthents are in the Mahogany Rockland 12+pz range site.

135F—Rock outcrop-Ruckles complex, 50 to 70 percent south slopes. This map unit is on hills. Areas are irregular in shape and are 40 to 200 acres in size. The native vegetation is mainly bunchgrasses and shrubs. Elevation is 2,000 to 3,800 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 130 days.

This unit is about 50 percent Rock outcrop and 35 percent Ruckles very stony clay loam. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of Ruclick soils. Also included are small areas of soils that are similar to the Ruckles soil but are less than 10 inches deep over bedrock. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Ruckles soil is shallow and well drained. It formed in colluvium derived from basalt and influenced by loess and volcanic ash in the surface layer. Typically, the surface layer is very dark grayish brown very stony clay loam about 5 inches thick. The subsoil is very stony clay. The upper 3 inches is dark brown, and the lower 3 inches is dark yellowish brown. The substratum is brown extremely stony sandy clay. It extends to a depth of about 16 inches. The depth to bedrock is 10 to 20 inches.

Permeability is slow in the Ruckles soil. Available water capacity is 1 to 2 inches. The effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is very high.

This unit is used mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on the Ruckles soil is dominated by bluebunch wheatgrass and lomatium.

Bluebunch wheatgrass is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 800 pounds per acre in favorable years and 300 pounds per acre in unfavorable years. Livestock access is limited by the slope, the Rock outcrop, and the stones on the surface.

If the condition of the site deteriorates through overgrazing, bluebunch wheatgrass loses vigor and decreases in extent. Sandberg bluegrass and lomatium increase in extent. If deterioration continues, cheatgrass and other annual plants invade the site.

Mechanical treatment for brush control and range seeding is not practical because of the slope and the stony surface layer.

The Ruckles soil is in the Shallow South 9-12pz range site.

136F—Rock outcrop-Ruclick complex, 50 to 70 percent north slopes. This unit is on hills. Areas are irregular in shape and are 100 to 400 acres in size. The native vegetation is mainly bunchgrasses, forbs, and shrubs. Elevation is 2,000 to 3,800 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 130 days.

This unit is about 50 percent Rock outcrop and 35 percent Ruclick very cobbly silt loam. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of Ruckles soils. Also included are small areas of soils that are similar to the Ruclick soil but are more than 40 inches deep over bedrock. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Ruclick soil is moderately deep and well drained. It formed in colluvium derived from basalt and influenced by loess and volcanic ash in the surface layer. Typically, the surface layer is very dark grayish brown very cobbly silt loam about 2 inches thick. The next layer is dark brown very gravelly silty clay loam about 10 inches thick. The upper 8 inches of the subsoil is dark brown very cobbly clay. The lower 14 inches is dark brown extremely cobbly clay. The depth to bedrock is 20 to 40 inches.

Permeability is moderate to a depth of about 12 inches in the Ruclick soil and slow below that depth. Available water capacity is 2 to 5 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is very high.

This unit is used mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on the Ruclick soil is dominated by Idaho fescue, bluebunch wheatgrass, and Wyoming big sagebrush.

Idaho fescue and bluebunch wheatgrass are the major forage-producing plants. If the site is in excellent condition, the total annual production is estimated at 1,700 pounds per acre in favorable years and 600 pounds per acre in unfavorable years. Livestock access is limited by the slope, the Rock outcrop, and the cobbles on the surface.

If the condition of the site deteriorates through overgrazing, Idaho fescue and bluebunch wheatgrass lose vigor and decrease in extent. Big sagebrush and Sandberg bluegrass increase in extent. If deterioration continues, cheatgrass and other annual plants invade the site.

Mechanical treatment for brush control and range seeding is not practical because of the slope, the cobbly surface layer, and the Rock outcrop.

The Ruclick soil is in the North 9-12pz range site.

137F—Rock outcrop-Snell complex, 50 to 80 percent north slopes. This map unit is on hills. Areas are irregular in shape and are 80 to 200 acres in size. The native vegetation is mainly bunchgrasses, forbs, and a few shrubs. Elevation is 3,400 to 5,000 feet. The average annual precipitation is 14 to 20 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 60 to 90 days.

This unit is about 60 percent Rock outcrop and 30 percent Snell very cobbly silt loam. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of Sag soils. Also included are small areas of soils that are similar to the Snell soil but are less than 20 inches deep over bedrock. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

The Snell soil is moderately deep and well drained. It formed in loess and in colluvium derived from basalt. Typically, the surface layer is very dark brown very cobbly silt loam about 4 inches thick. The next layer is very dark brown very cobbly silty clay loam about 5 inches thick. The subsoil is dark brown extremely cobbly clay about 22 inches thick. The depth to bedrock is 20 to 40 inches.

Permeability is moderate to a depth of about 9 inches in the Snell soil and moderately slow below that depth. Available water capacity is 2 to 5 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is very high.

This unit is used for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on the Snell soil is dominated by Idaho fescue and common snowberry.

Idaho fescue is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 2,200 pounds per acre in favorable years and 1,200 pounds per acre in unfavorable years. Livestock access is limited by the Rock outcrop, the slope, and the cobbles on the surface.

If the condition of the site deteriorates through overgrazing, Idaho fescue loses vigor and decreases in extent. Bluebunch wheatgrass increases in extent. Bluegrasses invade. If deterioration continues, the extent of bluebunch wheatgrass decreases and cheatgrass and other annual plants strongly invade the site.

Mechanical treatment for brush control and range seeding is not practical because of the Rock outcrop, the slope, and the cobbles on the surface.

The Snell soil is in the North 14-17pz range site.

138F—Rock outcrop-Snellby complex, 50 to 80 percent north slopes. This map unit is on hills. Areas are irregular in shape and are 20 to 200 acres in size. The native vegetation is mainly bunchgrasses and shrubs. Elevation is 3,400 to 3,800 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 41 to 45 degrees F, and the average frost-free period is 60 to 90 days.

This unit is about 50 percent Rock outcrop and 35 percent Snellby stony silt loam. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of soils that are similar to the Snellby soil but are more than 40 inches deep over bedrock. Also included are small areas of soils that are similar to the Snellby soil but are less than 20 inches deep over bedrock. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Snellby soil is moderately deep and well drained. It formed in colluvium derived from basalt and influenced by volcanic ash and loess in the surface layer. Typically, the surface layer is dark brown stony silt loam about 6 inches thick. The next layer is 4 inches thick and is dark brown stony silty clay loam. The subsoil is dark yellowish brown very stony clay about 14 inches thick. The depth to bedrock is 20 to 40 inches.

Permeability is moderate to a depth of about 10 inches in the Snellby soil and slow below that depth. Available water capacity is 2 to 5 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is very high.

This unit is used mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on the Snellby soil is dominated by Idaho fescue and Wyoming big sagebrush.

Idaho fescue is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 1,700 pounds per acre in favorable years and 600 pounds per acre in unfavorable years. Livestock access is limited by the slope, the Rock outcrop, and the stones on the surface.

If the condition of the site deteriorates through overgrazing, Idaho fescue loses vigor and decreases in extent. Sandberg bluegrass and Wyoming big sagebrush increase in extent. If deterioration continues, annual grasses and forbs invade the site.

Mechanical treatment for brush control and range seeding is not practical because of the slope, the Rock outcrop, and the stones on the surface.

The Snellby soil is in the Mountain North 9-12pz range site.

139F—Rock outcrop-Xeric Torriorthents-Darkcanyon complex, 50 to 80 percent south slopes. This map unit is on hills. Areas are irregular in shape and are 100 to 400 acres in size. The native vegetation is mainly bunchgrasses, shrubs, and forbs. Elevation is 2,000 to 4,000 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 110 to 130 days.

This unit is about 35 percent Rock outcrop, 30 percent Xeric Torriorthents, and 25 percent Darkcanyon extremely channery loam. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of Snaker soils. Also included are small areas of soils that are similar to the Snaker soil but are less than 10 inches deep over bedrock. Included soils make up about 10 percent of the total acreage. The percentage varies from one area to another.

The Xeric Torriorthents are very shallow to moderately deep and are well drained or somewhat excessively drained. They formed in colluvium and residuum derived from schist. Typically, the surface layer is grayish brown extremely channery loam about 16 inches thick. The substratum is pale brown extremely channery sandy loam about 18 inches thick. The depth to highly fractured bedrock is 8 to 40 inches.

Permeability is moderately rapid in the Xeric Torriorthents. Available water capacity varies. The effective rooting depth is 8 to 40 inches. Runoff is rapid, and the hazard of water erosion is very high.

The Darkcanyon soil is moderately deep and well drained. It formed in colluvium and residuum derived from schist and graywacke. Typically, the surface layer is light gray extremely channery loam about 7 inches thick. The subsoil is light brownish gray extremely channery loam about 23 inches thick. The depth to bedrock is 20 to 40 inches.

Permeability is moderate in the Darkcanyon soil. Available water capacity is 2 to 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is very high.

This unit is used mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on the Xeric Torriorthents is dominated by curlleaf mountainmahogany, bluebunch wheatgrass, antelope bitterbrush, and Nevada greasebush.

Bluebunch wheatgrass is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 900 pounds per acre in favorable years and 300 pounds per acre in unfavorable years. Livestock access is limited by the slope, the Rock outcrop, and the rock fragments on the surface.

The potential plant community on the Darkcanyon soil is dominated by bluebunch wheatgrass and Nevada greasebush.

Bluebunch wheatgrass is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 1,200 pounds per acre in favorable years and 400 pounds per acre in unfavorable years. Livestock access is limited by the slope, the Rock outcrop, and the rock fragments on the surface.

If the condition of the site deteriorates through overgrazing, bluebunch wheatgrass, curlleaf mountainmahogany, and antelope bitterbrush lose vigor and decrease in extent. Perennial forbs and shrubs increase in extent. If deterioration continues, cheatgrass and other annual plants invade the site.

Range seeding is not practical because of the slope and rock fragments on the surface. Brush control is not advisable because of the value of curlleaf mountainmahogany and antelope bitterbrush for wildlife.

The Xeric Torriorthents are in the Mahogany Rockland 9-12pz range site. The Darkcanyon soil is in the South Schist 9-12pz range site.

140C—Rockly-Gwinly complex, 2 to 12 percent slopes. This map unit is on hills. Areas are irregular in shape and are 40 to 400 acres in size. The native vegetation is mainly bunchgrasses and forbs. Elevation is 2,500 to 4,000 feet. The average annual precipitation is 14 to 20 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 120 days.

This unit is about 50 percent Rockly very cobbly loam and 40 percent Gwinly very cobbly silt loam. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of Immig soils and Rock outcrop. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

The Rockly soil is very shallow and well drained. It formed in colluvium derived from basalt and loess. Typically, the surface layer is very dark brown very cobbly loam about 2 inches thick. The subsoil is about 6 inches of dark brown extremely cobbly loam and clay loam. The depth to bedrock is 5 to 10 inches.

Permeability is moderate in the Rockly soil. Available water capacity is 0.5 to 1.0 inch. The effective rooting depth is 5 to 10 inches. Runoff is slow or medium, and the hazard of water erosion is slight or moderate.

The Gwinly soil is shallow and well drained. It formed in colluvium derived from basalt and influenced by loess and volcanic ash in the surface layer (fig. 10). Typically, the surface layer is very dark brown very cobbly silt loam about 3 inches thick. The upper 5 inches of the subsoil is very dark brown very cobbly silty clay loam. The lower 9 inches is dark brown extremely cobbly clay. The depth to bedrock is 10 to 20 inches.

Permeability is slow in the Gwinly soil. Available water capacity is 1 to 2 inches. The effective rooting depth is 10 to 20 inches. Runoff is slow or medium, and the hazard of water erosion is slight or moderate.

Figure 10.—Typical profile of Gwinly very cobbly silt loam, 2 to 8 percent slopes, in an area of Rockly-Gwinly complex, 2 to 12 percent slopes.

This unit is used mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on the Rockly soil is dominated by Sandberg bluegrass, bluebunch wheatgrass, and stiff sagebrush.

Sandberg bluegrass and bluebunch wheatgrass are the major forage-producing plants. If the site is in excellent condition, the total annual production is estimated at 600 pounds per acre in favorable years and 200 pounds per acre in unfavorable years. Livestock access is limited by the very cobbly surface layer.

The potential plant community on the Gwinly soil is dominated by Idaho fescue, bluebunch wheatgrass, and arrowleaf balsamroot.

Idaho fescue and bluebunch wheatgrass are the major forage-producing plants. If the site is in excellent condition, the total annual production is estimated at 900 pounds per acre in favorable years and 300 pounds per acre in unfavorable years. Livestock access is limited by the very cobbly surface layer.

If the condition of the site deteriorates through overgrazing, Idaho fescue and bluebunch wheatgrass lose vigor and decrease in extent. Sandberg bluegrass increases in extent, and other bluegrasses invade. If deterioration continues, cheatgrass and other annual plants invade the site.

Mechanical treatment for brush control and range seeding is not practical because of the cobbles on the surface.

The Rockly soil is in the Very Shallow 14+pz range site. The Gwinly soil is in the Shallow Clayey 14-17pz range site.

141D—Roostercomb-Longbranch complex, 12 to 35 percent north slopes. This map unit is on hills. Areas are irregular in shape and are 80 to 400 acres in size. The native vegetation is mainly bunchgrasses, forbs, and shrubs. Elevation is 3,800 to 5,700 feet. The average annual precipitation is 12 to 16 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 50 to 90 days.

This unit is about 60 percent Roostercomb extremely gravelly clay loam and 30 percent Longbranch silt loam. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of Ateron soils. Also included are small areas of Rock outcrop. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

The Roostercomb soil is moderately deep and well drained. It formed in colluvium derived from greenstone. Typically, the surface layer is dark brown extremely gravelly clay loam about 12 inches thick. The upper 13 inches of the subsoil is dark yellowish brown extremely gravelly clay. The lower 11 inches is dark yellowish brown extremely cobbly clay. The depth to bedrock is 20 to 40 inches.

Permeability in the Roostercomb soil is moderate to a depth of about 12 inches and slow below that depth. Available water capacity is 2 to 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate or high.

The Longbranch soil is deep and well drained. It formed in colluvium derived from greenstone. Typically, the surface layer is very dark gray silt loam about 22 inches thick. The upper 8 inches of the subsoil is very dark grayish brown gravelly clay loam. The next 15 inches is yellowish brown very gravelly and very cobbly clay. The lower part of the subsoil is light yellowish brown extremely cobbly clay loam. It extends to a depth of about 52 inches. The depth to bedrock is typically 40 to 60 inches but is more than 60 inches in some areas.

Permeablility of the Longbranch soil is moderately slow to a depth of about 30 inches and slow below that depth. Available water capacity is 6 to 10 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 livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on the Roostercomb soil is dominated by Idaho fescue, mountain big sagebrush, and squaw apple.

Idaho fescue is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 2,200 pounds per acre in favorable years and 1,000 pounds per acre in unfavorable years.

The potential plant community on the Longbranch soil is dominated by Idaho fescue, basin wildrye, mountain big sagebrush, and wax currant.

Idaho fescue is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 2,500 pounds per acre in favorable years and 1,500 pounds per acre in unfavorable years.

If the condition of the site deteriorates through overgrazing, Idaho fescue loses vigor and decreases in extent. Mountain big sagebrush and bluebunch wheatgrass increase in extent. Bluegrasses invade. If deterioration continues, the extent of bluebunch wheatgrass decreases, the extent of mountain big sagebrush strongly increases, and annual grasses and forbs invade the site.

The Roostercomb soil is in the Mountain North 12-16pz range site. The Longbranch soil is in the Mountain North 12-16pz range site.

141E—Roostercomb-Longbranch complex, 35 to 50 percent north slopes. This map unit is on hills. Areas are irregular in shape and are 80 to 400 acres in size. The native vegetation is mainly bunchgrasses, forbs, and shrubs. Elevation is 3,800 to 5,700 feet. The average annual precipitation is 12 to 16 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 50 to 90 days.

This unit is about 50 percent Roostercomb extremely gravelly clay loam and 40 percent Longbranch silt loam. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of Ateron soils.

Also included are small areas of Rock outcrop. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

The Roostercomb soil is moderately deep and well drained. It formed in colluvium derived from greenstone. Typically, the surface layer is dark brown extremely gravelly clay loam about 12 inches thick. The upper 13 inches of the subsoil is dark yellowish brown extremely gravelly clay. The lower 11 inches is dark yellowish brown extremely cobbly clay. The depth to bedrock is 20 to 40 inches.

Permeability in the Roostercomb soil is moderate to a depth of about 12 inches and slow below that depth. Available water capacity is 2 to 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

The Longbranch soil is deep and well drained. It formed in colluvium derived from greenstone. Typically, the surface layer is very dark gray silt loam about 22 inches thick. The upper 8 inches of the subsoil is very dark grayish brown gravelly clay loam. The next 15 inches is yellowish brown very gravelly and very cobbly clay. The lower part of the subsoil is light yellowish brown extremely cobbly clay loam. It extends to a depth of about 52 inches. The depth to bedrock is typically 40 to 60 inches but is more than 60 inches in some areas.

Permeablility of the Longbranch soil is moderately slow to a depth of about 30 inches and slow below that depth. Available water capacity is 6 to 10 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 mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on the Roostercomb soil is dominated by Idaho fescue, mountain big sagebrush, and squaw apple.

Idaho fescue is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 2,200 pounds per acre in favorable years and 1,000 pounds per acre in unfavorable years. Livestock access is limited by the slope.

The potential plant community on the Longbranch soil is dominated by Idaho fescue, basin wildrye, mountain big sagebrush, and wax currant.

Idaho fescue is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 2,500 pounds per acre in favorable years and 1,500 pounds per acre in unfavorable years. Livestock access is limited by the slope.

If the condition of the site deteriorates through overgrazing, Idaho fescue loses vigor and decreases in extent. Mountain big sagebrush, basin wildrye, and bluebunch wheatgrass increase in extent. If deterioration continues, the extent of bluebunch wheatgrass decreases and the extent of mountain big sagebrush and squaw apple strongly increases. Some areas are bare, and annual plants invade the site.

Mechanical treatment for brush control and range seeding is not practical because of the slope.

The Roostercomb soil is in the Mountain North 12-16pz range site. The Longbranch soil is in the Mountain North 12-16pz range site.

142C—Ruckles-Ruclick complex, 2 to 12 percent slopes. This map unit is on hills. Areas are irregular in shape and are 100 to 400 acres in size. The native vegetation is mainly bunchgrasses and shrubs. Elevation is 2,000 to 3,800 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 130 days.

This unit is about 50 percent Ruckles very stony clay loam and 35 percent Ruclick very cobbly silt loam. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of Bakeoven soils. Also included are small areas of Rock outcrop. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Ruckles soil is shallow and well drained. It formed in colluvium derived from basalt and influenced by loess and volcanic ash in the surface layer. Typically, the surface layer is very dark grayish brown very stony clay loam about 5 inches thick. The subsoil is very stony clay. The upper 3 inches is dark brown, and the lower 3 inches is dark yellowish brown. The substratum is brown extremely stony sandy clay. It extends to a depth of about 16 inches. The depth to bedrock is 10 to 20 inches.

Permeability is slow in the Ruckles soil. Available water capacity is 1 to 2 inches. The effective rooting depth is 10 to 20 inches. Runoff is slow or medium, and the hazard of water erosion is slight or moderate.

The Ruclick soil is moderately deep and well drained. It formed in colluvium derived from basalt and influenced by loess and volcanic ash in the surface layer. Typically, the surface layer is very dark grayish brown very cobbly silt loam about 2 inches thick. The subsurface layer is dark brown very gravelly silty clay loam about 10 inches thick. The upper 8 inches of the subsoil is dark brown very cobbly clay. The lower 14 inches is dark brown and dark yellowish brown extremely cobbly clay. The depth to bedrock is 20 to 40 inches.

Permeability is moderate to a depth of about 12 inches in the Ruclick soil and slow below that depth. Available water capacity is 2 to 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 mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on the Ruckles soil is dominated by Idaho fescue and Wyoming big sagebrush.

Idaho fescue is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 1,200 pounds per acre in favorable years and 300 pounds per acre in unfavorable years. Livestock access is limited by the very stony surface layer.

The potential plant community on the Ruclick soil is dominated by Idaho fescue and Wyoming big sagebrush.

Bluebunch wheatgrass is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 1,500 pounds per acre in favorable years and 500 pounds per acre in unfavorable years. Livestock access is limited by the very cobbly surface layer.

If the condition of the site deteriorates through overgrazing, Idaho fescue loses vigor and decreases in extent. Bluebunch wheatgrass, Sandberg bluegrass, and Wyoming big sagebrush increase in extent. If deterioration continues, the extent of bluebunch wheatgrass decreases and cheatgrass and other annual plants invade the site.

Mechanical treatment for brush control and range seeding is not practical because of the very cobbly or stony surface layer.

The Ruckles soil is in the Mountain Shallow 9-12pz range site. The Ruclick soil is in the Mountain Clayey 9-12pz range site.

143D—Ruckles-Ruclick complex, 12 to 35 percent south slopes. This map unit is on hills. Areas are irregular in shape and are 100 to 400 acres in size. The native vegetation is mainly bunchgrasses and shrubs. Elevation is 2,000 to 3,800 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 130 days.

This unit is about 50 percent Ruckles very stony clay loam and 35 percent Ruclick very cobbly silt loam. The components of this unit are so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of Bakeoven soils. Also included are small areas of Rock outcrop. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Ruckles soil is shallow and well drained. It formed in colluvium derived from basalt and influenced by volcanic ash and loess in the surface layer. Typically, the surface layer is very dark grayish brown very stony clay loam about 5 inches thick. The subsoil is very stony clay. The upper 3 inches is dark brown, and the lower 3 inches is dark yellowish brown. The substratum is brown extremely stony sandy clay. It extends to a depth of about 16 inches. The depth to bedrock is 10 to 20 inches.

Permeability is slow in the Ruckles soil. Available water capacity is 1 to 2 inches. The effective rooting depth is 10 to 20 inches. Runoff is medium, and the hazard of water erosion is moderate or high.

The Ruclick soil is moderately deep and well drained. It formed in colluvium derived from basalt and influenced by loess and volcanic ash in the surface layer. Typically, the surface layer is very dark grayish brown very cobbly silt loam about 2 inches thick. The subsurface layer is dark brown very gravelly silty clay loam about 10 inches thick. The upper 8 inches of the subsoil is dark brown very cobbly clay. The lower 14 inches is dark brown and dark yellowish brown extremely cobbly clay. The depth to bedrock is 20 to 40 inches.

Permeability is moderate to a depth of about 12 inches in the Ruclick soil and slow below that depth. Available water capacity is 2 to 5 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 mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on the Ruckles soil is dominated by bluebunch wheatgrass and Wyoming big sagebrush.

Bluebunch wheatgrass is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 800 pounds per acre in favorable years and 300 pounds per acre in unfavorable years. Livestock access is limited by the very stony surface layer.

The potential plant community on the Ruclick soil is dominated by bluebunch wheatgrass and Wyoming big sagebrush.

Bluebunch wheatgrass is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 1,200 pounds per acre in favorable years and 400 pounds per acre in unfavorable years. Livestock access is limited by the very cobbly surface layer.

If the condition of the site deteriorates through overgrazing, bluebunch wheatgrass loses vigor and decreases in extent. Sandberg bluegrass, lomatium, and Wyoming big sagebrush increase in extent. If deterioration continues, cheatgrass and other annual plants invade the site.

Mechanical treatment for brush control and range seeding is not practical because of the very cobbly or stony surface layer.

The Ruckles soil is in the Shallow South 9-12pz range site. The Ruclick soil is in the Clayey South 9-12pz range site.

143E—Ruckles-Ruclick complex, 35 to 50 percent south slopes. This map unit is on hills. Areas are irregular in shape and are 100 to 400 acres in size. The native vegetation is mainly bunchgrasses and shrubs. Elevation is 2,000 to 3,800 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 130 days.

This unit is about 55 percent Ruckles very stony clay loam and 30 percent Ruclick very cobbly silt loam. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of Bakeoven soils. Also included are small areas of Rock outcrop. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Ruckles soil is shallow and well drained. It formed in colluvium derived from basalt and influenced by loess and volcanic ash in the surface layer. Typically, the surface layer is very dark grayish brown very stony clay loam about 5 inches thick. The subsoil is very stony clay. The upper 3 inches is dark brown, and the lower 3 inches is dark yellowish brown. The substratum is brown extremely stony sandy clay. It extends to a depth of about 16 inches. The depth to bedrock is 10 to 20 inches.

Permeability is slow in the Ruckles soil. Available water capacity is 1 to 2 inches. The effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is high.

The Ruclick soil is moderately deep and well drained. It formed in colluvium derived from basalt and influenced by loess and volcanic ash in the surface layer. Typically, the surface layer is very dark grayish brown very cobbly silt loam about 2 inches thick. The subsurface layer is dark brown very gravelly silty clay loam about 10 inches thick. The upper 8 inches of the subsoil is dark brown very cobbly clay. The lower 14 inches is dark brown and dark yellowish brown extremely cobbly clay. The depth to bedrock is 20 to 40 inches.

Permeability is moderate to a depth of about 12 inches in the Ruclick soil and slow below that depth. Available water capacity is 2 to 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 mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on the Ruckles soil is dominated by bluebunch wheatgrass and Wyoming big sagebrush.

Bluebunch wheatgrass is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 800 pounds per acre in favorable years and 300 pounds per acre in unfavorable years. Livestock access is limited by the slope and the very stony surface layer.

The potential plant community on the Ruclick soil is dominated by bluebunch wheatgrass and Wyoming big sagebrush.

Bluebunch wheatgrass is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 1,200 pounds per acre in favorable years and 400 pounds per acre in unfavorable years. Livestock access is limited by the slope and the very cobbly surface layer.

If the condition of the site deteriorates through overgrazing, bluebunch wheatgrass loses vigor and decreases in extent. Sandberg bluegrass and lomatium increase in extent. If deterioration continues, cheatgrass and other annual plants invade the site.

Mechanical treatment for brush control and range seeding is not practical because of the slope and the very cobbly or stony surface layer.

The Ruckles soil is in the Shallow South 9-12pz range site. The Ruclick soil is in the Clayey South 9-12pz range site.

143F—Ruckles-Ruclick complex, 50 to 70 percent south slopes. This map unit is on hills. Areas are irregular in shape and are 100 to 400 acres in size. The native vegetation is mainly bunchgrasses and shrubs. Elevation is 2,000 to 3,800 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 130 days.

This unit is about 60 percent Ruckles very stony clay loam and 30 percent Ruclick very cobbly silt loam. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of Bakeoven soils. Also included are small areas of Rock outcrop.

Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

The Ruckles soil is shallow and well drained. It formed in colluvium derived from basalt and influenced by loess and volcanic ash in the surface layer. Typically, the surface layer is very dark grayish brown very stony clay loam about 5 inches thick. The subsoil is very stony clay. The upper 3 inches is dark brown, and the lower 3 inches is dark yellowish brown. The substratum is brown extremely stony sandy clay. It extends to a depth of about 16 inches. The depth to bedrock is 10 to 20 inches.

Permeability is slow in the Ruckles soil. Available water capacity is 1 to 2 inches. The effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is very high.

The Ruclick soil is moderately deep and well drained. It formed in colluvium derived from basalt. Typically, the surface layer is very dark grayish brown very cobbly silt loam about 2 inches thick. The subsurface layer is dark brown very gravelly silty clay loam about 10 inches thick. The upper 8 inches of the subsoil is dark brown very cobbly clay. The lower 14 inches is dark brown and dark yellowish brown extremely cobbly clay. The depth to bedrock is 20 to 40 inches.

Permeability is moderate to a depth of about 12 inches in the Ruclick soil and slow below that depth. Available water capacity is 2 to 5 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is very high.

This unit is used mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on the Ruckles soil is dominated by bluebunch wheatgrass and Wyoming big sagebrush.

Bluebunch wheatgrass is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 800 pounds per acre in favorable years and 300 pounds per acre in unfavorable years. Livestock access is limited by the slope and the very stony surface layer.

The potential plant community on the Ruclick soil is dominated by bluebunch wheatgrass and Wyoming big sagebrush.

Bluebunch wheatgrass is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 1,200 pounds per acre in favorable years and 400 pounds per acre in unfavorable years. Livestock access is limited by the slope and the very cobbly surface layer.

If the condition of the site deteriorates through overgrazing, bluebunch wheatgrass loses vigor and decreases in extent. Sandberg bluegrass and lomatium increase in extent. If deterioration continues, cheatgrass and other annual plants invade the site.

Mechanical treatment for brush control and range seeding is not practical because of the slope and the very cobbly or stony surface layer.

The Ruckles soil is in the Shallow South 9-12pz range site. The Ruclick soil is in the Clayey South 9-12pz range site.

144E—Ruckles-Ruclick-Snellby complex, 35 to 50 percent slopes. This map unit is on hills. Areas are irregular in shape and are 100 to 400 acres in size. The native vegetation is mainly bunchgrasses, shrubs, and forbs. Elevation is 3,400 to 3,800 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 60 to 130 days.

This unit is about 40 percent Ruckles very stony clay loam, 25 percent Ruclick very cobbly silt loam, and 25 percent Snellby stony silt loam. Typically, the Ruckles soil is in convex areas, and the Ruclick soil is in concave areas. Both soils generally are on south and west aspects. The Snellby soils are typically on north and east aspects. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of Rock outcrop and Bakeoven soils on south and west aspects. Also included are small areas of soils that are similar to the Snellby soil on north aspects but are more than 40 inches deep over bedrock. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

The Ruckles soil is shallow and well drained. It formed in colluvium derived from basalt and influenced by loess and volcanic ash in the surface layer. Typically, the surface layer is very dark grayish brown very stony clay loam about 5 inches thick. The subsoil is dark brown and dark yellowish brown very stony clay. The depth to bedrock is 10 to 20 inches.

Permeability is slow in the Ruckles soil. Available water capacity is 1 to 2 inches. The effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is high.

The Ruclick soil is moderately deep and well drained. It formed in colluvium derived from basalt and influenced by loess and volcanic ash in the surface layer. Typically, the surface layer is very dark grayish brown very cobbly silt loam about 2 inches thick. The subsurface layer is dark brown very gravelly silty clay loam about 10 inches thick. The upper 8 inches of the subsoil is dark brown very cobbly clay. The lower 14 inches is dark brown and dark yellowish brown extremely cobbly clay. The depth to bedrock is 20 to 40 inches.

Permeability is moderate to a depth of about 12 inches in the Ruclick soil and slow below that depth. Available water capacity is 2 to 5 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

The Snellby soil is moderately deep and well drained. It formed in colluvium derived from basalt and influenced by loess and volcanic ash in the surface layer. Typically, the surface layer is dark brown stony silt loam about 6 inches thick. The upper 4 inches of the subsoil is dark brown stony silty clay loam. The lower 14 inches is dark yellowish brown very stony clay. The depth to bedrock is 20 to 40 inches.

Permeability is moderate to a depth of about 10 inches in the Snellby soil and slow below that depth. Available water capacity is 2 to 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 mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on the Ruckles soil is dominated by bluebunch wheatgrass and Wyoming big sagebrush.

Bluebunch wheatgrass is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 800 pounds per acre in favorable years and 300 pounds per acre in unfavorable years. Livestock access is limited by the slope and the very stony surface layer.

The potential plant community on the Ruclick soil is dominated by bluebunch wheatgrass and Wyoming big sagebrush.

Bluebunch wheatgrass is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 1,200 pounds per acre in favorable years and 400 pounds per acre in unfavorable years. Livestock access is limited by the slope and the very cobbly surface layer.

The potential plant community on the Snellby soil consists of Idaho fescue and Wyoming big sagebrush.

Idaho fescue is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 1,700 pounds per acre in favorable years and 600 pounds per acre in unfavorable years. Livestock access is limited by the slope and the stony surface layer.

If the condition of the sites deteriorates through overgrazing, Idaho fescue loses vigor and decreases in extent. Sandberg bluegrass and Wyoming big sagebrush increase in extent. If deterioration continues, cheatgrass and other annual plants invade the site.

Mechanical treatment for brush control and range seeding is not practical because of the slope and the cobbles and stones on the surface.

The Ruckles soil is in the Shallow South 9-12pz range site. The Ruclick soil is in the Clayey South 9-12pz range site. The Snellby soil is in the Mountain North 9-12pz range site.

144F—Ruckles-Ruclick-Snellby complex, 50 to 70 percent slopes. This map unit is on hills. Areas are irregular in shape and are 100 to 400 acres in size. The native vegetation is mainly bunchgrasses, shrubs, and forbs. Elevation is 3,400 to 3,800 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 60 to 130 days.

This unit is about 40 percent Ruckles very stony clay loam, 25 percent Ruclick very cobbly silt loam, and 20 percent Snellby stony silt loam. Typically, the Ruckles soil is in convex areas, and the Ruclick soil is in concave areas. Both soils generally are on south and west aspects. The Snellby soil typically is on north and east aspects. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of Rock outcrop and Bakeoven soils on south and west aspects. Also included are small areas of soils that are similar to the Snellby soil on north aspects but are more than 40 inches deep over bedrock. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Ruckles soil is shallow and well drained. It formed in colluvium derived from basalt and influenced by loess and volcanic ash in the surface layer. Typically, the surface layer is very dark grayish brown very stony clay loam about 5 inches thick. The subsoil is dark brown and dark yellowish brown very stony clay. The depth to bedrock is 10 to 20 inches.

Permeability is slow in the Ruckles soil. Available water capacity is 1 to 2 inches. The effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is very high.

The Ruclick soil is moderately deep and well drained. It formed in colluvium derived from basalt and influenced by loess and volcanic ash. Typically, the surface layer is very dark grayish brown very cobbly silt loam about 2 inches thick. The subsurface layer is dark brown very gravelly silty clay loam about 10 inches thick. The upper 8 inches of the subsoil is dark brown very cobbly clay. The lower 14 inches is dark brown and dark yellowish brown extremely cobbly clay. The depth to bedrock is 20 to 40 inches.

Permeability is moderate to a depth of about 12 inches in the Ruclick soil and slow below that depth. Available water capacity is 2 to 5 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is very high.

The Snellby soil is moderately deep and well drained. It formed in colluvium derived from basalt and influenced by loess and volcanic ash in the surface layer. Typically, the surface layer is dark brown stony silt loam about 6 inches thick. The upper 4 inches of the subsoil is dark brown stony silty clay loam. The lower 14 inches is dark yellowish brown very stony clay. The depth to bedrock is 20 to 40 inches.

Permeability is moderate to a depth of about 10 inches in the Snellby soil and slow below that depth. Available water capacity is 2 to 5 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is very high.

This unit is used mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on the Ruckles soil is dominated by bluebunch wheatgrass and Wyoming big sagebrush.

Bluebunch wheatgrass is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 800 pounds per acre in favorable years and 300 pounds per acre in unfavorable years. Livestock access is limited by the slope and the very stony surface layer.

The potential plant community on the Ruclick soil is dominated by bluebunch wheatgrass and Wyoming big sagebrush.

Bluebunch wheatgrass is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 1,200 pounds per acre in favorable years and 400 pounds per acre in unfavorable years. Livestock access is limited by the slope and the very cobbly surface layer.

The potential plant community on the Snellby soil is dominated by Idaho fescue and Wyoming big sagebrush.

Idaho fescue is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 1,700 pounds per acre in favorable years and 600 pounds per acre in unfavorable years. Livestock access is limited by the slope and the stony surface layer.

If the condition of the site deteriorates through overgrazing, Idaho fescue and bluebunch wheatgrass lose vigor and decrease in extent. Sandberg bluegrass and Wyoming big sagebrush increase in extent. If deterioration continues, cheatgrass and other annual plants invade the site.

Mechanical treatment for brush control and range seeding is not practical because of the slope and the cobbles and stones on the surface.

The Ruckles soil is in the Shallow South 9-12pz range site. The Ruclick soil is in the Clayey South 9-12pz range site. The Snellby soil is in the Mountain North 9-12pz range site.

145D—Ruclick very cobbly silt loam, 12 to 35 percent north slopes. This moderately deep, well drained soil is on hills. It formed in colluvium derived from basalt and influenced by loess and volcanic ash. Areas are irregular in shape and are 100 to 400 acres in size. The native vegetation is mainly bunchgrasses, forbs, and shrubs. Elevation is 2,000 to 3,400 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 130 days.

Typically, the surface layer is very dark grayish brown very cobbly silt loam about 2 inches thick. The subsurface layer is dark brown very gravelly silty clay loam about 10 inches thick. The upper 8 inches of the subsoil is dark brown very cobbly clay. The lower 14 inches is dark brown extremely cobbly clay. The depth to bedrock is 20 to 40 inches.

Included in this unit are small areas of Ruckles soils and Rock outcrop. Also included are small areas of soils that are similar to the Ruclick soil but are more than 40 inches deep over bedrock. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate to a depth of about 12 inches in the Ruclick soil and slow below that depth. Available water capacity is 2 to 5 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 mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on this unit is dominated by Idaho fescue, bluebunch wheatgrass, and big sagebrush.

Idaho fescue and bluebunch wheatgrass are the major forage-producing plants. If the site is in excellent condition, the total annual production is estimated at 1,700 pounds per acre in favorable years and 600 pounds per acre in unfavorable years. Livestock access is limited by the very cobbly surface layer.

If the condition of the site deteriorates through overgrazing, Idaho fescue loses vigor and decreases in extent. Bluebunch wheatgrass, Sandberg bluegrass, and big sagebrush increase in extent. If deterioration continues, the extent of bluebunch wheatgrass decreases and cheatgrass and other annual plants invade the site.

Mechanical treatment for brush control and range seeding is not practical because of the very cobbly surface layer.

The Ruclick soil is in the North 9-12pz range site.

145E—Ruclick very cobbly silt loam, 35 to 50 percent north slopes. This moderately deep, well drained soil is on hills. It formed in colluvium derived from basalt and influenced by loess and volcanic ash. Areas are irregular in shape and are 100 to 400 acres in size. The native vegetation is mainly bunchgrasses, forbs, and shrubs. Elevation is 2,000 to 3,400 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 130 days.

Typically, the surface layer is very dark grayish brown very cobbly silt loam about 2 inches thick. The subsurface layer is dark brown very gravelly silty clay loam about 10 inches thick. The upper 8 inches of the subsoil is dark brown very cobbly clay. The lower 14 inches is dark brown extremely cobbly clay. The depth to bedrock is 20 to 40 inches.

Included in this unit are small areas of Ruckles soils and Rock outcrop. Also included are small areas of soils that are similar to the Ruclick soil but are more than 40 inches deep over bedrock. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate to a depth of about 12 inches and in the Ruclick soil and slow below that depth. Available water capacity is 2 to 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 mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on this unit is dominated by Idaho fescue, bluebunch wheatgrass, and big sagebrush.

Idaho fescue and bluebunch wheatgrass are the major forage-producing plants. If the site is in excellent condition, the total annual production is estimated at 1,700 pounds per acre in favorable years and 600 pounds per acre in unfavorable years. Livestock access is limited by the slope and the very cobbly surface layer.

If the condition of the site deteriorates through overgrazing, Idaho fescue loses vigor and decreases in extent. Bluebunch wheatgrass, Sandberg bluegrass, and big sagebrush increase in extent. If deterioration continues, the extent of bluebunch wheatgrass decreases and cheatgrass and other annual plants invade the site.

Mechanical treatment for brush control and range seeding is not practical because of the slope and the very cobbly surface layer.

The Ruclick soil is in the North 9-12pz range site.

146D—Sag-Snell complex, 12 to 35 percent north slopes. This map unit is on hills. Areas are irregular in shape and are 80 to 400 acres in size. The native vegetation is mainly bunchgrasses, forbs, and a few scattered shrubs. Elevation is 3,400 to 5,000 feet. The average annual precipitation is 14 to 20 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 60 to 90 days.

This unit is about 60 percent Sag silt loam and 25 percent Snell very cobbly silt loam. Typically, the Sag soil is in concave areas, and the Snell soil is in convex areas. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of soils that are similar to the Sag soil but have stones and cobbles on the surface. Also included are small areas of soils that are similar to the Snell soil but are less than 20 or more than 40 inches deep over bedrock. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Sag soil is deep and well drained. It formed in colluvium derived from basalt and influenced by loess and volcanic ash in the surface layer. Typically, the surface layer is very dark brown silt loam about 22 inches thick. The upper 18 inches of the subsoil is dark brown silty clay loam. The next 18 inches is dark brown very cobbly and extremely cobbly clay. The lower part of the subsoil is dark brown extremely cobbly clay. It extends to a depth of about 58 inches. The depth to fractured bedrock is typically 40 to 60 inches but is more than 60 inches in some areas.

Permeability is moderate to a depth of about 40 inches in the Sag soil and slow below that depth. Available water capacity is 6 to 10 inches. The effective rooting depth is 40 to 60 inches. Runoff is medium, and the hazard of water erosion is moderate or high.

The Snell soil is moderately deep and well drained. It formed in loess and in colluvium derived from basalt. Typically, the surface layer is very dark brown very cobbly silt loam about 4 inches thick. The next layer is very dark brown very cobbly silty clay loam about 5 inches thick. The subsoil is dark brown extremely cobbly clay about 22 inches thick. The depth to bedrock is 20 to 40 inches.

Permeability is moderate to a depth of about 9 inches in the Snell soil and moderately slow below that depth. Available water capacity is 2 to 5 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 mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on the Sag soil is dominated by Idaho fescue, snowberry, and common chokecherry.

Idaho fescue and bluebunch wheatgrass are the major forage-producing plants. If the site is in excellent condition, the total annual production is estimated at 2,500 pounds per acre in favorable years and 1,500 pounds per acre in unfavorable years.

The potential plant community on the Snell soil is dominated by Idaho fescue and common snowberry.

Idaho fescue and bluebunch wheatgrass are the major forage-producing plants. If the site is in excellent condition, the total annual production is estimated at 2,200 pounds per acre in favorable years and 1,200 pounds per acre in unfavorable years. Livestock access is limited by the very cobbly surface layer.

If the condition of the site deteriorates through overgrazing, Idaho fescue and bluebunch wheatgrass lose vigor and decrease in extent. Sandberg and other bluegrasses invade. If deterioration continues, cheatgrass, medusahead, and other annual plants invade the site.

Mechanical treatment for range seeding and brush control is limited by the very cobbly surface layer of the Snell soil. Brush control is not advisable because of the value of chokecherry, hawthorn, and other deciduous shrubs on this unit for wildlife food and cover.

The Sag soil is in the Deep North 14-17pz range site. The Snell soil is in the North 14-17pz range site.

146E—Sag-Snell complex, 35 to 50 percent north slopes. This map unit is on hills. Areas are irregular in shape and are 80 to 400 acres in size. The native vegetation is mainly bunchgrasses, forbs, and a few scattered shrubs. Elevation is 3,400 to 5,000 feet. The average annual precipitation is 14 to 20 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 60 to 90 days.

This unit is about 50 percent Sag silt loam and 40 percent Snell very cobbly silt loam. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of soils that are similar to the Sag soil but have stones and cobbles on the surface. Also included are small areas of soils that are similar to the Snell soil but are less than 20 or more than 40 inches deep over bedrock. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

The Sag soil is deep and well drained. It formed in colluvium derived from basalt and influenced by loess and volcanic ash in the surface layer. Typically, the surface layer is very dark brown silt loam about 22 inches thick. The upper 18 inches of the subsoil is dark brown silty clay loam. The next 18 inches is dark brown very cobbly and extremely cobbly clay. The lower part of the subsoil is dark brown extremely cobbly clay. It extends to a depth of about 58 inches. The depth to fractured bedrock is typically 40 to 60 inches but is more than 60 inches in some areas.

Permeability is moderate to a depth of about 40 inches in the Sag soil and slow below that depth. Available water capacity is 6 to 10 inches. The effective rooting depth is 40 to 60 inches. Runoff is rapid, and the hazard of water erosion is high.

The Snell soil is moderately deep and well drained. It formed in loess and in colluvium derived from basalt. Typically, the surface layer is very dark brown very cobbly silt loam about 4 inches thick. The next layer is very dark brown very cobbly silty clay loam about 5 inches thick. The subsoil is dark brown extremely cobbly clay about 22 inches thick. The depth to bedrock is 20 to 40 inches.

Permeability is moderate to a depth of about 9 inches in the Snell soil and moderately slow below that depth. Available water capacity is 2 to 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 mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on the Sag soil is dominated by Idaho fescue, snowberry, and common chokecherry.

Idaho fescue and bluebunch wheatgrass are the major forage-producing plants. If the site is in excellent condition, the total annual production is estimated at 2,500 pounds per acre in favorable years and 1,500 pounds per acre in unfavorable years. Livestock access is limited by the slope.

The potential plant community on the Snell soil is dominated by Idaho fescue and common snowberry.

Idaho fescue and bluebunch wheatgrass are the major forage-producing plants. If the site is in excellent condition, the total annual production is estimated at 2,200 pounds per acre in favorable years and 1,200 pounds per acre in unfavorable years. Livestock access is limited by the slope and the very cobbly surface layer.

If the condition of the site deteriorates through overgrazing, Idaho fescue and bluebunch wheatgrass lose vigor and decrease in extent. Sandberg and other bluegrasses increase or invade. If deterioration continues, cheatgrass, medusahead, and other annual plants invade the site.

Mechanical treatment for range seeding is limited by the slope. The Snell soil also is limited by a very cobbly surface layer. Brush control is not advisable because of the value of chokecherry, hawthorn, and other deciduous shrubs on this unit for wildlife food and cover.

The Sag soil is in the Deep North 14-17pz range site. The Snell soil is in the North 14-17pz range site.

147D—Segundo very gravelly loam, 2 to 35 percent south slopes. This deep, well drained soil is on mountains. It formed in colluvium derived from rhyolite and andesite. Areas are irregular in shape and are 80 to 400 acres in size. The native vegetation is mainly conifers, shrubs, bunchgrasses, and forbs. Elevation is 4,000 to 6,000 feet. The average annual precipitation is 16 to 30 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 60 to 90 days.

Typically, the surface layer is very dark brown very gravelly loam about 5 inches thick. The subsoil is brown very gravelly loam about 16 inches thick. The substratum to a depth of 60 inches or more is brown very gravelly sandy loam and multicolored extremely gravelly loamy sand.

Included in this unit are small areas of Inkler and Stavely soils. Also included are small areas of Anatone and Baldridge soils. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate in the subsoil of the Segundo soil and moderately rapid in the substratum. Available water capacity is 4 to 7 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 mainly for timber production. It also is used for livestock grazing, and it provides habitat for many kinds of wildlife.

Woodland.—This unit is suited to the production of ponderosa pine and Douglas-fir. The mean site index is 71 for ponderosa pine (100-year base age) and 63 for Douglas-fir (50-year base age). The potential production at culmination of the mean annual increment for ponderosa pine is 56 cubic feet per acre per year (3.9 cubic meters per hectare per year) in a 50-year-old, even-aged, fully stocked stand and for Douglas-fir is 49 cubic feet per acre per year (3.4 cubic meters per hectare per year) in a 108-year-old, even-aged, fully stocked stand.

The main concerns in producing and harvesting timber are the hazard of erosion, the equipment limitation, seedling mortality, plant competition, and fire damage to the soil.

Minimizing the risk of erosion is essential in areas where timber is harvested. Properly designed road drainage systems that include carefully located culverts help to control erosion. Spoil from excavations is subject to rill and gully erosion and to sloughing. Roads, landings, skid trails, and firebreaks can be protected against erosion by constructing water bars and by seeding areas that have been cut and filled. Buffer strips may be needed in areas adjacent to perennial streams to minimize siltation and maintain stream temperatures.

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. The risk of compaction can be reduced by using low-pressure ground equipment, laying out skid trails in advance, and harvesting timber when the soil is dry or frozen. Compaction limits the movement of water and air in the soil and restricts the growth of roots. Cable yarding systems that partially or fully suspend logs generally do less damage to the soil than conventional ground-based systems.

Careful management of reforestation is needed to minimize competition from undesirable plants. If the site is not adequately prepared, plant competition can prevent or delay the reestablishment of volunteer or planted trees. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying.

The seedling mortality rate is increased by compaction of the surface layer and by droughtiness in the surface layer. The high content of rock fragments also limits seedling survival. To compensate for the higher expected mortality rate, larger seedlings or a greater number of seedlings than is typical can be planted. Shading and mulching of seedlings may be required. The trees that are suitable for planting include ponderosa pine.

Some decline in forest productivity may result from fire of moderate intensity.

Grazable woodland.—This unit is suitable for use as grazable woodland. The understory consists mainly of common snowberry, spirea, elk sedge, pinegrass, low Oregongrape, and strawberry. The potential production of the native understory plants in a normal year is about 800 pounds of air-dry forage per acre.

A system that results in proper grazing use is essential if livestock graze this unit. Timely deferment of grazing is needed to allow the desirable plants to mature and set seed. Grazing should be delayed in spring until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.

Seeding disturbed areas to suitable plants increases forage production. Deferred grazing is needed during periods when seedlings are becoming established.

This soil can produce adequate forage for big game animals after the tree canopy is opened by logging, fire, or some other disturbance. Dense stands of timber should be left in some areas to provide escape and thermal cover for the big game animals.

The Segundo soil is in the Pine-Fir-Sedge woodland understory site.

147E—Segundo very gravelly loam, 35 to 50 percent south slopes. This deep, well drained soil is on mountains. It formed in colluvium derived from rhyolite and andesite. Areas are irregular in shape and are 80 to 400 acres in size. The native vegetation is mainly conifers, shrubs, bunchgrasses, and forbs. Elevation is 4,000 to 6,000 feet. The average annual precipitation is 16 to 30 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 60 to 90 days.

Typically, the surface layer is very dark brown very gravelly loam about 5 inches thick. The subsoil is brown very gravelly loam about 16 inches thick. The substratum to a depth of 60 inches or more is brown very gravelly sandy loam and multicolored extremely gravelly loamy sand.

Included in this unit are small areas of Stavely soils. Also included are small areas of Anatone and Baldridge soils. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate in the subsoil of the Segundo soil and moderately rapid in the substratum. Available water capacity is 4 to 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 mainly for timber production. It also is used for livestock grazing, and it provides habitat for many kinds of wildlife.

Woodland.—This unit is suited to the production of ponderosa pine and Douglas-fir. The mean site index is 71 for ponderosa pine (100-year base age) and 63 for Douglas-fir (50-year base age). The potential production at culmination of the mean annual increment for ponderosa pine is 56 cubic feet per acre per year (3.9 cubic meters per hectare per year) in a 50-year-old, even-aged, fully stocked stand and for Douglas-fir is 49 cubic feet per acre per year (3.4 cubic meters per hectare per year) in a 108-year-old, even-aged, fully stocked stand.

The main concerns in producing and harvesting timber are the hazard of erosion, the equipment limitation, seedling mortality, plant competition, and fire damage to the soil.

Minimizing the risk of erosion is essential in areas where timber is harvested. Properly designed road drainage systems that include carefully located culverts help to control erosion. Spoil from excavations is subject to rill and gully erosion and to sloughing. Roads, landings, skid trails, and firebreaks can be protected against erosion by constructing water bars and by seeding areas that have been cut and filled. Buffer strips may be needed in areas adjacent to perennial streams to minimize siltation and maintain stream temperatures.

The slope restricts the use of wheeled and tracked equipment. High-lead or other logging systems that fully or partially suspend the logs above the ground cause less damage to the soil than tractor systems and reduce the risk of compaction. The risk of compaction also can be reduced by using low-pressure ground equipment, laying out skid trails in advance, and harvesting timber when the soil is dry or frozen.

Careful management of reforestation is needed to minimize competition from undesirable plants. If the site is not adequately prepared, plant competition can prevent or delay the reestablishment of volunteer or planted trees. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying. Scarification is severely restricted in the steeper areas because of increased expense and soil displacement.

The seedling mortality rate is increased by compaction of the surface layer and by droughtiness in the surface layer. The high content of rock fragments also limits seedling survival. To compensate for the higher expected mortality rate, larger seedlings or a greater number of seedlings than is typical can be planted. Shading and mulching of seedlings may be required. The trees that are suitable for planting include ponderosa pine.

Decline in forest productivity is likely to result from fire of moderate intensity.

Grazable woodland.—This unit is suitable for use as grazable woodland. The understory consists mainly of common snowberry, spirea, elk sedge, pinegrass, low Oregongrape, and strawberry. The potential production of the native understory plants in a normal year is about 800 pounds of air-dry forage per acre.

A system that results in proper grazing use is essential if livestock graze this unit. Timely deferment of grazing is needed to allow the desirable plants to mature and set seed. Grazing should be delayed in spring until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.

Seeding disturbed areas to suitable plants increases the forage production and reduces soil loss. Deferred grazing is needed during periods when seedlings are becoming established.

This soil can produce adequate forage for big game animals after the tree canopy is opened by logging, fire, or some other disturbance. Dense stands of timber should be left in some areas to provide escape and thermal cover for the big game animals.

The Segundo soil is in the Pine-Fir-Sedge woodland understory site.

147F—Segundo very gravelly loam, 50 to 75 percent south slopes. This deep, well drained soil is on mountains. It formed in colluvium derived from rhyolite and andesite. Areas are irregular in shape and are 80 to 400 acres in size. The native vegetation is mainly conifers, shrubs, bunchgrasses, and forbs. Elevation is 4,000 to 6,000 feet. The average annual precipitation is 16 to 30 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 60 to 90 days.

Typically, the surface layer is very dark brown very gravelly loam about 5 inches thick. The subsoil is brown very gravelly loam about 16 inches thick. The substratum to a depth of 60 inches or more is brown very gravelly sandy loam and multicolored extremely gravelly loamy sand.

Included in this unit are small areas of Stavely and Anatone soils. Also included are small areas of Baldridge and Sisley soils. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate in the subsoil of the Segundo soil and moderately rapid in the substratum. Available water capacity is 4 to 7 inches. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is very high.

This unit is used mainly for timber production. It also provides habitat for many kinds of wildlife.

Woodland.—This unit is suited to the production of ponderosa pine and Douglas-fir. The mean site index is 71 for ponderosa pine (100-year base age) and 63 for Douglas-fir (50-year base age). The potential production at culmination of the mean annual increment for ponderosa pine is 56 cubic feet per acre per year (3.9 cubic meters per hectare per year) in a 50-year-old, even-aged, fully stocked stand and for Douglas-fir is 49 cubic feet per acre per year (3.4 cubic meters per hectare per year) in a 108-year-old, even-aged, fully stocked stand.

The main concerns in producing and harvesting timber are the hazard of erosion, the equipment limitation, seedling mortality, plant competition, and fire damage to the soil.

Minimizing the risk of erosion is essential in areas where timber is harvested. Properly designed road drainage systems that include carefully located culverts help to control erosion. Spoil from excavations is subject to rill and gully erosion and to sloughing. Roads, landings, skid trails, and firebreaks can be protected against erosion by constructing water bars and by seeding areas that have been cut and filled. Buffer strips may be needed in areas adjacent to perennial streams to minimize siltation and maintain stream temperatures.

The slope prevents the use of wheeled and tracked equipment. High-lead or other logging systems that fully suspend the logs above the ground cause less damage to the soil than other systems. The risk of compaction can be reduced by using suitable harvesting methods and by harvesting when the soil is dry or frozen.

Careful management of reforestation is needed to minimize competition from undesirable plants. If the site is not adequately prepared, plant competition can prevent or delay the reestablishment of volunteer or planted trees. Competing weeds, brush, or trees can be controlled by spraying, cutting, or girdling.

Droughtiness in the surface layer increases the seedling mortality rate. The high content of rock fragments also limits seedling survival. To compensate for the higher expected mortality rate, larger seedlings or a greater number of seedlings than is typical can be planted. Shading and mulching of seedlings may be required. The trees that are suitable for planting include ponderosa pine.

Decline in forest productivity is likely to result from fire of moderate intensity.

The understory consists mainly of common snowberry, spirea, elk sedge, pinegrass, low Oregongrape, and strawberry.

This soil can produce adequate forage for big game animals after the tree canopy is opened by logging, fire, or some other disturbance. Dense stands of timber should be left in some areas to provide escape and thermal cover for the big game animals.

The Segundo soil is in the Pine-Fir-Sedge woodland understory site.

148F—Sinker very channery loam, 50 to 80 percent north slopes. This moderately deep, well drained soil is on hills. It formed in colluvium derived from schist and graywacke. Areas are irregular in shape and are 100 to 400 acres in size. The native vegetation is mainly bunchgrasses, shrubs, and forbs. Elevation is 3,500 to 5,300 feet. The average annual precipitation is 12 to 16 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 60 to 90 days.

Typically, the surface layer is very dark gray and very dark grayish brown very channery loam about 15 inches thick. The subsoil is very dark grayish brown and dark grayish brown extremely channery loam about 17 inches thick. The depth to fractured bedrock is 20 to 40 inches.

Included in this unit are small areas of Chambeam and Lostbasin soils and Rock outcrop. Also included are small areas of soils that are similar to the Sinker soil but are less than 20 inches deep over fractured bedrock. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate in the Sinker soil. Available water capacity is 2 to 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is very high.

This unit is used mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on this unit is dominated by Idaho fescue, squaw apple, and big sagebrush.

Idaho fescue is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 2,200 pounds per acre in favorable years and 1,000 pounds per acre in unfavorable years. Livestock access is limited by the slope and rock fragments on the surface.

If the condition of the site deteriorates through overgrazing, Idaho fescue loses vigor and decreases in extent. Mountain big sagebrush and bluebunch wheatgrass increase in extent. Bluegrasses invade. If deterioration continues, the extent of bluebunch wheatgrass decreases, the extent of mountain big sagebrush strongly increases, and annual grasses and forbs invade the site.

Mechanical treatment for brush control and range seeding is not practical because of the slope and rock fragments on the surface.

The Sinker soil is in the Mountain North 12-16pz range site.

149D—Sinker and Chambeam soils, 12 to 35 percent north slopes. This map unit is on hills. Areas are irregular in shape and are 100 to 400 acres in size. The native vegetation is mainly bunchgrasses, shrubs, and forbs. Elevation is 3,500 to 5,300 feet. The average annual precipitation is 12 to 16 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 60 to 90 days.

The Sinker and Chambeam soils are not in a definite pattern. Either or both soils can occupy a mapped area.

Included in this unit are small areas of Lostbasin soils. Also included are small areas of soils that are similar to the Sinker soil but are less than 20 inches deep over fractured bedrock. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

The Sinker soil is moderately deep and well drained. It formed in colluvium derived from schist and graywacke. Typically, the surface layer is very dark gray and very dark grayish brown very channery loam about 15 inches thick. The subsoil is very dark grayish brown and dark grayish brown extremely channery loam about 17 inches thick. The depth to bedrock is 20 to 40 inches.

Permeability is moderate in the Sinker soil. Available water capacity is 2 to 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate or high.

The Chambeam soil is deep and well drained. It formed in colluvium derived from schist and graywacke. Typically, the surface layer is very dark brown and very dark grayish brown very channery loam about 17 inches thick. The upper 10 inches of the subsoil is dark brown very channery loam. The lower 7 inches is dark brown extremely channery loam. The substratum is grayish brown extremely channery loam about 11 inches thick. The depth to bedrock is 40 to 60 inches.

Permeability is moderate in the Chambeam soil. Available water capacity is 2 to 5 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 livestock grazing (fig. 11). It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on this unit is dominated by Idaho fescue, squaw apple, and big sagebrush.

Idaho fescue is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 2,200 pounds per acre in favorable years and 1,000 pounds per acre in unfavorable years. Livestock access is limited by rock fragments on the surface.

If the condition of the site deteriorates through overgrazing, Idaho fescue loses vigor and decreases in extent. Mountain big sagebrush and bluebunch wheatgrass increase in extent. Bluegrasses invade. If deterioration continues, the extent of bluebunch wheatgrass decreases, the extent of mountain big sagebrush strongly increases, and annual grasses and forbs invade the site.

Mechanical treatment for brush control and range seeding is limited by rock fragments on the surface.

The Sinker and Chambeam soils are in the Mountain North 12-16pz range site.

149E—Sinker and Chambeam soils, 35 to 50 percent north slopes. This map unit is on hills. Areas are irregular in shape and are 100 to 400 acres in size. The native vegetation is mainly bunchgrasses, shrubs, and forbs. Elevation is 3,500 to 5,300 feet. The average annual precipitation is 12 to 16 inches, the average annual air temperature is 40 to 45 degrees F, and the

Figure 11.—Rangeland on Sinker and Chambeam soils, 12 to 35 percent north slopes. Black Mountain in the background.

average frost-free period is 60 to 90 days.

The Sinker and Chambeam soils are not in a definite pattern. Either or both soils can occupy a mapped area.

Included in this unit are small areas of Lostbasin soils and Rock outcrop. Also included are small areas of soils that are similar to the Sinker soil but are less than 20 inches deep over fractured bedrock. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Sinker soil is moderately deep and well drained. It formed in colluvium derived from schist and graywacke. Typically, the surface layer is very dark gray and very dark grayish brown very channery loam about 15 inches thick. The subsoil is very dark grayish brown and dark grayish brown extremely channery loam about 17 inches thick. The depth to bedrock is 20 to 40 inches.

Permeability is moderate in the Sinker soil. Available water capacity is 2 to 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

The Chambeam soil is deep and well drained. It formed in colluvium derived from schist and graywacke. Typically, the surface layer is very dark brown and very dark grayish brown very channery loam about 17 inches thick. The upper 10 inches of the subsoil is dark brown very channery loam. The lower 7 inches is dark brown extremely channery loam. The substratum is grayish brown extremely channery loam about 11 inches thick. The depth to bedrock is 40 to 60 inches.

Permeability is moderate in the Chambeam soil. Available water capacity is 2 to 5 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 mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on this unit is dominated by Idaho fescue, squaw apple, and big sagebrush.

Idaho fescue is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 2,200 pounds per acre in favorable years and 1,000 pounds per acre in unfavorable years. Livestock access is limited by the slope.

If the condition of the site deteriorates through overgrazing, Idaho fescue loses vigor and decreases in extent. Mountain big sagebrush and bluebunch wheatgrass increase in extent. Bluegrasses invade. If deterioration continues, the extent of bluebunch wheatgrass decreases, the extent of mountain big sagebrush strongly increases, and annual grasses and forbs invade the site.

Mechanical treatment for brush control and range seeding is not practical because of the slope and rock fragments on the surface.

The Sinker and Chambeam soils are in the Mountain North 12-16pz range site.

150D—Sisley very channery loam, 2 to 35 percent south slopes. This moderately deep, well drained soil is on mountains. It formed in residuum and colluvium derived from schist. Areas are irregular in shape and are 80 to 400 acres in size. The native vegetation is mainly conifers, shrubs, bunchgrasses, and forbs. Elevation is 4,000 to 6,000 feet. The average annual precipitation is 16 to 30 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 50 to 90 days.

Typically, the surface layer is very dark grayish brown very channery loam about 3 inches thick. The subsoil is grayish brown very channery loam about 5 inches thick. The substratum is grayish brown extremely channery sandy loam. It extends to a depth of about 24 inches. The depth to bedrock is 20 to 40 inches.

Included in this unit are small areas of Lostbasin, Piersonte, and Segundo soils. Also included are small areas of soils that are similar to the Sisley soil but are less than 20 inches deep over fractured bedrock. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate in the Sisley soil. Available water capacity is 2 to 4 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 mainly for timber production. It also is used for livestock grazing, and it provides habitat for many kinds of wildlife.

Woodland.—This unit is suited to the production of ponderosa pine and Douglas-fir. The mean site index is 68 for ponderosa pine (100-year base age) and 58 for Douglas-fir (50-year base age). The potential production at culmination of the mean annual increment for ponderosa pine is 53 cubic feet per acre per year (3.7 cubic meters per hectare per year) in a 50-year-old, even-aged, fully stocked stand and for Douglas-fir is 41 cubic feet per acre per year (2.9 cubic meters per hectare per year) in a 111-year-old, even-aged, fully stocked stand.

The main concerns in producing and harvesting timber are the hazard of erosion, the equipment limitation, seedling mortality, the hazard of windthrow, plant competition, and fire damage to the soil.

Minimizing the risk of erosion is essential in areas where timber is harvested. Properly designed road drainage systems that include carefully located culverts help to control erosion. Spoil from excavations is subject to rill and gully erosion and to sloughing. Roads, landings, skid trails, and firebreaks can be protected against erosion by constructing water bars and by seeding areas that have been cut and filled. Buffer strips may be needed in areas adjacent to perennial streams to minimize siltation and maintain stream temperatures.

Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. The risk of compaction can be reduced by using low-pressure ground equipment, laying out skid trails in advance, and harvesting timber when the soil is dry or frozen. Compaction limits the movement of water and air in the soil and restricts the growth of roots. Cable yarding systems that partially or fully suspend logs generally do less damage to the soil than conventional ground-based systems.

Careful management of reforestation is needed to minimize competition from undesirable plants. If the site is not adequately prepared, plant competition can prevent or delay the reestablishment of volunteer or planted trees. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying.

The seedling mortality rate is increased by compaction of the surface layer and by droughtiness in the surface layer. The high content of rock fragments also limits seedling survival. To compensate for the higher expected mortality rate, larger seedlings or a greater number of seedlings than is typical can be planted. Shading and mulching of seedlings may be required. The trees that are suitable for planting include ponderosa pine.

Trees are subject to windthrow because of the limited rooting depth, especially during periods when the soil is excessively wet and winds are strong. Regeneration systems that isolate single trees or groups of trees are not practical because of the hazard of windthrow.

Some decline in forest productivity may result from fire of moderate intensity.

Grazable woodland.—This unit is suitable for use as grazable woodland. The understory consists mainly of common snowberry, antelope bitterbrush, mountain big sagebrush, Idaho fescue, bluebunch wheatgrass, and western juniper. The potential production of the native understory plants in a normal year is about 800 pounds of air-dry forage per acre.

A system that results in proper grazing use is essential if livestock graze this unit. Timely deferment of grazing is needed to allow the desirable plants to mature and set seed. Grazing should be delayed in spring until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.

Seeding disturbed areas to suitable plants increases forage production and reduces soil loss. Deferred grazing is needed during periods when seedlings are becoming established.

This soil can produce adequate forage for big game animals after the tree canopy is opened by logging, fire, or some other disturbance. Stands of timber should be left in some areas to provide escape and thermal cover for the big game animals.

The Sisley soil is in the Pine-Bitterbrush-Fescue woodland understory site.

150E—Sisley very channery loam, 35 to 50 percent south slopes. This moderately deep, well drained soil is on mountains. It formed in residuum and colluvium derived from schist. Areas are irregular in shape and are 80 to 400 acres in size. The native vegetation is mainly conifers, shrubs, bunchgrasses, and forbs. Elevation is 4,000 to 6,000 feet. The average annual precipitation is 16 to 30 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 50 to 90 days.

Typically, the surface layer is very dark grayish brown very channery loam about 3 inches thick. The subsoil is grayish brown very channery loam about 5 inches thick. The substratum is grayish brown extremely channery sandy loam. It extends to a depth of about 24 inches. The depth to bedrock is 20 to 40 inches.

Included in this unit are small areas of Lostbasin, Piersonte, and Segundo soils. Also included are small areas of soils that are similar to the Sisley soil but are less than 20 inches deep over bedrock. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate in the Sisley soil. Available water capacity is 2 to 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 timber production. It also is used for livestock grazing, and it provides habitat for many kinds of wildlife.

Woodland.—This unit is suited to the production of ponderosa pine and Douglas-fir. The mean site index is 68 for ponderosa pine (100-year base age) and 58 for Douglas-fir (50-year base age). The potential production at culmination of the mean annual increment for ponderosa pine is 53 cubic feet per acre per year (3.7 cubic meters per hectare per year) in a 50-year-old, even-aged, fully stocked stand and for Douglas-fir is 41 cubic feet per acre per year (2.9 cubic meters per hectare per year) in a 111-year-old, even-aged, fully stocked stand.

The main concerns in producing and harvesting timber are the hazard of erosion, the equipment limitation, seedling mortality, the hazard of windthrow, plant competition, and fire damage to the soil.

Minimizing the risk of erosion is essential in areas where timber is harvested. Properly designed road drainage systems that include carefully located culverts help to control erosion. Spoil from excavations is subject to rill and gully erosion and to sloughing. Roads, landings, skid trails, and firebreaks can be protected against erosion by constructing water bars and by seeding areas that have been cut and filled. Buffer strips may be needed in areas adjacent to perennial streams to minimize siltation and maintain stream temperatures.

The slope restricts the use of wheeled and tracked equipment. High-lead or other logging systems that fully or partially suspend the logs above the ground cause less damage to the soil than tractor systems and reduce the risk of compaction. The risk of compaction also can be reduced by using low-pressure ground equipment, laying out skid trails in advance, and harvesting timber when the soil is dry or frozen.

Careful management of reforestation is needed to minimize competition from undesirable plants. If the site is not adequately prepared, plant competition can prevent or delay the reestablishment of volunteer or planted trees. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying. Scarification is severely restricted in the steeper areas because of increased expense and soil displacement.

The seedling mortality rate is increased by compaction of the surface layer and by droughtiness in the surface layer. The high content of rock fragments also limits seedling survival. To compensate for the higher expected mortality rate, larger seedlings or a greater number of seedlings than is typical can be planted. Shading and mulching of seedlings may be required. The trees that are suitable for planting include ponderosa pine.

Trees are subject to windthrow because of the limited rooting depth, especially during periods when the soil is excessively wet and winds are strong. Regeneration systems that isolate single trees or groups of trees are not practical because of the hazard of windthrow.

Decline in forest productivity is likely to result from fire of moderate intensity.

Grazable woodland.—This unit is suitable for use as grazable woodland. The understory consists mainly of common snowberry, antelope bitterbrush, mountain big sagebrush, Idaho fescue, bluebunch wheatgrass, and western juniper. The potential production of the native understory plants in a normal year is about 800 pounds of air-dry forage per acre.

A system that results in proper grazing use is essential if livestock graze this unit. Timely deferment of grazing is needed to allow the desirable plants to mature and set seed. Grazing should be delayed in spring until the soil has drained sufficiently and is firm enough to withstand trampling by livestock

Seeding disturbed areas to suitable plants reduces the hazard of erosion and provides forage for livestock and wildlife. Deferred grazing is needed during periods when seedlings are becoming established.

This soil can produce adequate forage for big game animals after the tree canopy is opened by logging, fire, or some other disturbance. Stands of timber should be left in some areas to provide escape and thermal cover for the big game animals.

The Sisley soil is in the Pine-Bitterbrush-Fescue woodland understory site.

150F—Sisley very channery loam, 50 to 70 percent south slopes. This moderately deep, well drained soil is on mountains. It formed in residuum and colluvium derived from schist. Areas are irregular in shape and are 80 to 400 acres in size. The native vegetation is mainly conifers, shrubs, bunchgrasses, and forbs. Elevation is 4,000 to 6,000 feet. The average annual precipitation is 16 to 30 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 50 to 90 days.

Typically, the surface layer is very dark grayish brown very channery loam about 3 inches thick. The subsoil is grayish brown very channery loam about 5 inches thick. The substratum is grayish brown extremely channery sandy loam. It extends to a depth of about 24 inches. The depth to bedrock is 20 to 40 inches.

Included in this unit are small areas of Lostbasin, Piersonte, and Segundo soils. Also included are small areas of soils that are similar to the Sisley soil but are less than 20 inches deep over bedrock. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate in the Sisley soil. Available water capacity is 2 to 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is very high.

This unit is used mainly for timber production. It also provides habitat for many kinds of wildlife.

Woodland.—This unit is suited to the production of ponderosa pine and Douglas-fir. The mean site index is 68 for ponderosa pine (100-year base age) and 58 for Douglas-fir (50-year base age). The potential production at culmination of the mean annual increment for ponderosa pine is 53 cubic feet per acre per year (3.7 cubic meters per hectare per year) in a 50-year-old, even-aged, fully stocked stand and for Douglas-fir is 41 cubic feet per acre per year (2.9 cubic meters per hectare per year) in a 111-year-old, even-aged, fully stocked stand.

The main concerns in producing and harvesting timber are the hazard of erosion, the equipment limitation, seedling mortality, the hazard of windthrow, plant competition, and fire damage to the soil.

Minimizing the risk of erosion is essential in areas where timber is harvested. Properly designed road drainage systems that include carefully located culverts help to control erosion. Spoil from excavations is subject to rill and gully erosion and to sloughing. Roads, landings, skid trails, and firebreaks can be protected against erosion by constructing water bars and by seeding areas that have been cut and filled. Buffer strips may be needed in areas adjacent to perennial streams to minimize siltation and maintain stream temperatures.

The slope prevents the use of wheeled and tracked equipment. High-lead or other logging systems that fully suspend the logs above the ground cause less damage to the soil than other systems. The risk of compaction can be reduced by using suitable harvesting methods and by harvesting when the soil is dry or frozen.

Careful management of reforestation is needed to minimize competition from undesirable plants. If the site is not adequately prepared, plant competition can prevent or delay the reestablishment of volunteer or planted trees. Competing weeds, brush, or trees can be controlled by spraying, cutting, or girdling.

Droughtiness in the surface layer increases the seedling mortality rate. The high content of rock fragments also limits seedling survival. To compensate for the higher expected mortality rate, larger seedlings or a greater number of seedlings than is typical can be planted. Shading and mulching of seedlings may be required. The trees that are suitable for planting include ponderosa pine.

Trees are subject to windthrow because of the limited rooting depth, especially during periods when the soil is excessively wet and winds are strong. Regeneration systems that isolate single trees or groups of trees are not practical because of the hazard of windthrow.

Decline in forest productivity is likely to result from fire of moderate intensity.

The understory consists mainly of antelope bitterbrush, mountain big sagebrush, western juniper, common snowberry, Idaho fescue, and bluebunch wheatgrass.

This soil can produce adequate forage for big game animals after the tree canopy is opened by logging, fire, or some other disturbance. Stands of timber should be left in some areas to provide escape and thermal cover for the big game animals.

The Sisley soil is in the Pine-Bitterbrush-Fescue woodland understory site.

151D—Skullgulch silty clay loam, 7 to 20 percent north slopes. This deep, well drained soil is on the side slopes of old terraces. It formed in mixed alluvium influenced by loess and volcanic ash in the surface layer. Areas are irregular in shape and are 40 to 200 acres in size. The native vegetation is mainly bunchgrasses, shrubs, and forbs. Elevation is 4,000 to 4,700 feet. The average annual precipitation is 12 to 16 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 60 to 90 days.

Typically, the surface layer is very dark grayish brown silty clay loam about 20 inches thick. The next layer is dark brown clay loam about 4 inches thick. The upper 15 inches of the subsoil is dark yellowish brown clay. The lower part to a depth of 60 inches or more is dark yellowish brown clay loam.

Included in this unit are small areas of Pritchard and Hibbard soils. Also included are small areas of Campcreek soils. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderately slow to a depth of about 24 inches in the Skullgulch soil and slow below that depth. Available water capacity is 8 to 11 inches. The effective rooting depth is limited by the dense clay subsoil at 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on this unit is dominated by Idaho fescue, squaw apple, and big sagebrush.

Idaho fescue is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 2,200 pounds per acre in favorable years and 1,000 pounds per acre in unfavorable years.

If the condition of the site deteriorates through overgrazing, Idaho fescue loses vigor and decreases in extent. Mountain big sagebrush and bluebunch wheatgrass increase in extent. Bluegrasses invade. If deterioration continues, the extent of bluebunch wheatgrass decreases, the extent of mountain big sagebrush strongly increases, and annual grasses and forbs invade the site.

The Skullgulch soil is in the Mountain North 12-16pz range site.

152F—Snaker channery loam, 50 to 80 percent south slopes. This shallow, well drained soil is on hills. Areas are irregular in shape and are 100 to 400 acres in size. It formed in colluvium derived from schist. The native vegetation is mainly bunchgrasses and forbs. Elevation is 2,000 to 4,000 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 45 to 51 degrees F, and the average frost-free period is 100 to 140 days.

Typically, the surface layer is brown channery loam about 3 inches thick. The substratum is brown very channery loam. It extends to a depth of about 16 inches. The depth to bedrock is 10 to 20 inches.

Included in this unit are small areas of Darkcanyon and Lovline soils. Also included are small areas of Rock outcrop and small areas of soils that are similar to the Snaker soil but are less than 10 inches deep over bedrock. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderately rapid in the Snaker soil. Available water capacity is 1 to 2 inches. The effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is very high.

This unit is used mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on this unit is dominated by bluebunch wheatgrass and Nevada greasebush.

Bluebunch wheatgrass is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 800 pounds per acre in favorable years and 300 pounds per acre in unfavorable years. Livestock access is limited by the slope.

If the condition of the site deteriorates through overgrazing, bluebunch wheatgrass loses vigor and decreases in extent. If deterioration continues, cheatgrass and other annual plants invade the site.

Mechanical treatment for brush control and range seeding is not practical because of the slope.

The Snaker soil is in the Shallow South Schist 9-12pz range site.

153E—Snaker-Darkcanyon complex, 30 to 50 percent south slopes. This map unit is on hills. Areas are irregular in shape and are 100 to 400 acres in size. The native vegetation is mainly bunchgrasses, shrubs, and forbs. Elevation is 2,000 to 4,000 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 130 days.

This unit is about 50 percent Snaker channery loam and 35 percent Darkcanyon extremely channery loam. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of Lovline soils and Rock outcrop. Also included are small areas of soils that are similar to the Snaker soil but are less than 10 inches deep over bedrock. Included soils make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Snaker soil is shallow and well drained. It formed in colluvium derived from schist. Typically, the surface layer is brown channery loam about 3 inches thick. The substratum is brown very channery loam. It extends to a depth of about 16 inches. The depth to bedrock is 10 to 20 inches.

Permeability is moderately rapid in the Snaker soil. Available water capacity is 1 to 2 inches. The effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is high.

The Darkcanyon soil is moderately deep and well drained. It formed in colluvium and residuum derived from schist and graywacke. Typically, the surface layer is grayish brown extremely channery loam about 7 inches thick. The subsoil is grayish brown extremely channery loam about 23 inches thick. The depth to bedrock is 20 to 40 inches.

Permeability is moderate in the Darkcanyon soil. Available water capacity is 2 to 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. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on the Snaker soil is dominated by bluebunch wheatgrass and Nevada greasebush.

Bluebunch wheatgrass is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 800 pounds per acre in favorable years and 300 pounds per acre in unfavorable years. Livestock access is limited by the slope.

The potential plant community on the Darkcanyon soil is dominated by bluebunch wheatgrass and Nevada greasebush.

Bluebunch wheatgrass is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 1,200 pounds per acre in favorable years and 400 pounds per acre in unfavorable years. Livestock access is limited by the slope and rock fragments on the surface.

If the condition of the site deteriorates through overgrazing, bluebunch wheatgrass loses vigor and decreases in extent. Cheatgrass and other annual plants invade the site.

Mechanical treatment for brush control and range seeding is not practical because of the slope of the Snaker and Darkcanyon soils and the rock fragments on the surface of the Darkcanyon soil.

The Snaker soil is in the Shallow South Schist 9-12pz range site. The Darkcanyon soil is in the South Schist 9-12pz range site.

154E—Snaker-Darkcanyon-Xeric Torriorthents complex, 30 to 50 percent south slopes. This map unit is on hills. Areas are irregular in shape and are 100 to 400 acres in size. The native vegetation is mainly bunchgrasses, shrubs, and forbs. Elevation is 2,000 to 4,000 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 130 days.

This unit is about 40 percent Snaker channery loam, 30 percent Darkcanyon extremely channery loam, and 20 percent Xeric Torriorthents. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of Lovline soils and Rock outcrop. Included soils make up about 10 percent of the total acreage. The percentage varies from one area to another.

The Snaker soil is shallow and well drained. It formed in colluvium derived from schist. Typically, the surface layer is brown channery loam about 3 inches thick. The substratum is brown very channery loam. It extends to a depth of about 16 inches. The depth to bedrock is 10 to 20 inches.

Permeability is moderately rapid in the Snaker soil. Available water capacity is 1 to 2 inches. The effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is high.

The Darkcanyon soil is moderately deep and well drained. It formed in colluvium and residuum derived from schist and graywacke. Typically, the surface layer is grayish brown channery loam about 7 inches thick. The subsoil is grayish brown extremely channery loam about 23 inches thick. The depth to bedrock is 20 to 40 inches.

Permeability is moderate in the Darkcanyon soil. Available water capacity is 2 to 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

The Xeric Torriorthents are very shallow to moderately deep and are well drained or somewhat excessively drained. They formed in colluvium and residuum derived from schist. Typically, the surface layer is grayish brown extremely channery loam about 16 inches thick. The substratum is pale brown extremely channery sandy loam about 18 inches thick. The depth to highly fractured, hard bedrock is 8 to 40 inches.

Permeability is moderately rapid in the Xeric Torriorthents. Available water capacity varies. The effective rooting depth is 8 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on the Snaker soil is dominated by bluebunch wheatgrass and Nevada greasebush.

Bluebunch wheatgrass is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 800 pounds per acre in favorable years and 300 pounds per acre in unfavorable years. Livestock access is limited by the slope.

The potential plant community on the Darkcanyon soil is dominated by bluebunch wheatgrass and Nevada greasebush.

Bluebunch wheatgrass is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 1,200 pounds per acre in favorable years and 400 pounds per acre in unfavorable years. Livestock access is limited by the slope.

The potential plant community on the Xeric Torriorthents is dominated by curlleaf mountainmahogany, bluebunch wheatgrass, antelope bitterbrush, and Nevada greasebush.

Bluebunch wheatgrass is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 900 pounds per acre in favorable years and 300 pounds per acre in unfavorable years. Livestock access is limited by the slope and rock fragments on the surface.

If the condition of the site deteriorates through overgrazing, bluebunch wheatgrass, curlleaf mountainmahogany, and antelope bitterbrush lose vigor and decrease in extent. Cheatgrass and other annual plants invade the site.

Mechanical treatment for range seeding is not practical because of the slope and the rock fragments on the Xeric Torriorthents. Brush control is not advisable because of the value of curlleaf mountainmahogany and antelope bitterbrush for wildlife.

The Snaker soil is in the Shallow South Schist 9-12pz range site. The Darkcanyon soil is in the South Schist 9-12pz range site. The Xeric Torriorthents are in the Mahogany Rockland 9-12pz range site.

155D—Snell-Ateron complex, 12 to 35 percent north slopes. This map unit is on hills. Areas are irregular in shape and are 80 to 200 acres in size. The native vegetation is mainly bunchgrasses, forbs, and shrubs. Elevation is 3,600 to 5,700 feet. The average annual precipitation is 14 to 16 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 60 to 90 days.

This unit is about 50 percent Snell very cobbly silt loam and 40 percent Ateron very stony loam. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of soils that are similar to the Ateron soil but are less than 10 inches deep over bedrock and soils that are similar to the Snell soil but are more than 40 inches deep over bedrock. Also included are small areas of Rock outcrop. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

The Snell soil is moderately deep and well drained. It formed in loess and in colluvium derived from basalt. Typically, the surface layer is very dark brown very cobbly silt loam about 4 inches thick. The next layer is very dark brown very cobbly silty clay loam about 5 inches thick. The subsoil is dark brown extremely cobbly clay about 22 inches thick. The depth to bedrock is 20 to 40 inches.

Permeability is moderate to a depth of about 9 inches in the Snell soil and moderately slow below that depth. Available water capacity is 2 to 5 inches. The effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate or high.

The Ateron soil is shallow and well drained. It formed in colluvium derived from basalt. Typically, the surface layer is very dark gray very stony loam about 6 inches thick. The next layer is very dark grayish brown very cobbly silty clay loam about 6 inches thick. The subsoil is dark brown very cobbly clay. It extends to a depth of about 17 inches. The depth to bedrock is 10 to 20 inches.

Permeability is moderate to a depth of about 12 inches in the Ateron soil and slow below that depth. Available water capacity is 1 to 2 inches. The effective rooting depth is 10 to 20 inches. Runoff is medium, and the hazard of water erosion is moderate or high.

This unit is used mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on the Snell soil is dominated by Idaho fescue, squaw apple, and big sagebrush.

Idaho fescue is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 2,200 pounds per acre in favorable years and 1,000 pounds per acre in unfavorable years. Livestock access is limited by the very cobbly surface layer.

The potential plant community on the Ateron soil is dominated by Idaho fescue and big sagebrush.

Idaho fescue is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 1,200 pounds per acre in favorable years and 600 pounds per acre in unfavorable years. Livestock access is limited by the very stony surface layer.

If the condition of the site deteriorates through overgrazing, Idaho fescue loses vigor and decreases in extent. Mountain big sagebrush, bluebunch wheatgrass, and Sandberg bluegrass increase in extent. Other bluegrasses invade. If deterioration continues, the extent of bluebunch wheatgrass decreases, the extent of mountain big sagebrush strongly increases, and annual grasses and forbs invade the site.

Mechanical treatment for brush control and range seeding is not practical because of the very stony or very cobbly surface layer.

The Snell soil is in the Mountain North 12-16pz range site. The Ateron soil is in the Mountain Shallow North 12-16pz range site.

155E—Snell-Ateron complex, 35 to 60 percent north slopes. This map unit is on hills. Areas are irregular in shape and are 80 to 200 acres in size. The native vegetation is mainly bunchgrasses, forbs, and shrubs. Elevation is 3,600 to 5,700 feet. The average annual precipitation is 14 to 16 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 60 to 90 days.

This unit is about 50 percent Snell very cobbly silt loam and 40 percent Ateron very stony loam. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of soils that are similar to the Snell soil but are more than 40 inches deep over bedrock. Also included are small areas of Rock outcrop. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

The Snell soil is moderately deep and well drained. It formed in loess and in colluvium derived from basalt. Typically, the surface layer is very dark brown very cobbly silt loam about 4 inches thick. The next layer is very dark brown very cobbly silty clay loam about 5 inches thick. The subsoil is dark brown extremely cobbly clay about 22 inches thick. The depth to bedrock is 20 to 40 inches.

Permeability is moderate to a depth of about 9 inches in the Snell soil and moderately slow below that depth. Available water capacity is 2 to 5 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high or very high.

The Ateron soil is shallow and well drained. It formed in colluvium derived from basalt. Typically, the surface layer is very dark gray very stony loam about 6 inches thick. The next layer is very dark grayish brown very cobbly silty clay loam about 6 inches thick. The subsoil is dark brown very cobbly clay. It extends to a depth of about 17 inches. The depth to bedrock is 10 to 20 inches.

Permeability is moderate to a depth of about 12 inches in the Ateron soil and slow below that depth. Available water capacity is 1 to 2 inches. The effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is high or very high.

This unit is used mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on the Snell soil is dominated by Idaho fescue, squaw apple, and big sagebrush.

Idaho fescue is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 2,200 pounds per acre in favorable years and 1,000 pounds per acre in unfavorable years. Livestock access is limited by the very cobbly surface layer and the slope.

The potential plant community on the Ateron soil is dominated by Idaho fescue and big sagebrush.

Idaho fescue is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 1,200 pounds per acre in favorable years and 600 pounds per acre in unfavorable years. Livestock access is limited by the very stony surface and the slope.

If the condition of the site deteriorates through overgrazing, Idaho fescue loses vigor and decreases in extent. Mountain big sagebrush, bluebunch wheatgrass, and Sandberg bluegrass increase in extent. Other bluegrasses invade. If deterioration continues, the extent of bluebunch wheatgrass decreases, the extent of mountain big sagebrush strongly increases, and annual grasses and forbs invade the site.

Mechanical treatment for brush control and range seeding is not practical because of the slope and the very stony or cobbly surface layer.

The Snell soil is in the Mountain North 12-16pz range site. The Ateron soil is in the Mountain Shallow North 12-16pz range site.

156D—Snell-Rock outcrop complex, 12 to 35 percent north slopes. This map unit is on hills. Areas are irregular in shape and are 100 to 400 acres in size. The native vegetation is mainly bunchgrasses, shrubs, and forbs. Elevation is 3,400 to 5,000 feet. The average annual precipitation is 14 to 20 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 60 to 90 days.

This unit is about 60 percent Snell very cobbly silt loam 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 selected scale.

Included in this unit are small areas of Ateron soils. Also included are small areas of soils that are similar to the Snell soil but are more than 40 inches deep over bedrock. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

The Snell soil is moderately deep and well drained. It formed in loess and in colluvium derived from basalt. Typically, the surface layer is very dark brown very cobbly silt loam about 4 inches thick. The next layer is very dark brown very cobbly silty clay loam about 5 inches thick. The subsoil is dark brown extremely cobbly clay about 22 inches thick. The depth to bedrock is 20 to 40 inches.

Permeability is moderate to a depth of about 9 inches in the Snell soil and moderately slow below that depth. Available water capacity is 2 to 5 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 mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on the Snell soil is dominated by Idaho fescue and common snowberry.

Idaho fescue and bluebunch wheatgrass are the major forage-producing plants. If the site is in excellent condition, the total annual production is estimated at 2,200 pounds per acre in favorable years and 1,200 pounds per acre in unfavorable years. Livestock access is limited by the very cobbly surface layer.

If the condition of the site deteriorates through overgrazing, Idaho fescue loses vigor and decreases in extent. Bluebunch wheatgrass and forbs increase in extent. Bluegrasses invade. If deterioration continues, the extent of bluebunch wheatgrass decreases and annual grasses and forbs strongly invade the site.

Mechanical treatment for brush control and range seeding is not practical because of the Rock outcrop and the very cobbly surface layer.

The Snell soil is in the North 14-17pz range site.

157F—Snell-Sag complex, 50 to 70 percent north slopes. This map unit is on hills. Areas are irregular in shape and are 80 to 200 acres in size. The native vegetation is mainly bunchgrasses, forbs, and shrubs. Elevation is 3,400 to 5,000 feet. The average annual precipitation is 14 to 20 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 60 to 90 days.

This unit is about 65 percent Snell very cobbly silt loam and 25 percent Sag silt loam. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of soils that are similar to the Snell soil but are less than 20 inches deep over bedrock. Also included are small areas of Rock outcrop. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

The Snell soil is moderately deep and well drained. It formed in loess and in colluvium derived from basalt. Typically, the surface layer is very dark brown very cobbly silt loam about 4 inches thick. The next layer is very dark brown very cobbly silty clay loam about 5 inches thick. The subsoil is dark brown extremely cobbly clay about 22 inches thick. The depth to bedrock is 20 to 40 inches.

Permeability is moderate to a depth of about 9 inches in the Snell soil and moderately slow below that depth. Available water capacity is 2 to 4 inches. The effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is very high.

The Sag soil is deep and well drained. It formed in colluvium derived from basalt and influenced by loess and volcanic ash in the surface layer. Typically, the surface layer is very dark brown silt loam about 22 inches thick. The upper 18 inches of the subsoil is dark brown silty clay loam. The next 18 inches is dark brown very cobbly and extremely cobbly clay. The lower part of the subsoil is dark brown extremely cobbly clay. It extends to a depth of about 58 inches. The depth to fractured bedrock is typically 40 to 60 inches but is more than 60 inches in some areas.

Permeability is moderate to a depth of about 40 inches in the Sag soil and slow below that depth. Available water capacity is 6 to 10 inches. The effective rooting depth is 40 to 60 inches. Runoff is rapid, and the hazard of water erosion is very high.

This unit is used mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on the Snell soil is dominated by Idaho fescue and common snowberry.

Idaho fescue is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 2,200 pounds per acre in favorable years and 1,200 pounds per acre in unfavorable years. Livestock access is limited on this unit by a very cobbly surface and the slope.

The potential plant community on the Sag soil is dominated by Idaho fescue, snowberry, and common chokecherry.

Idaho fescue is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 2,500 pounds per acre in favorable years and 1,500 pounds per acre in unfavorable years. Livestock access is limited by the slope.

If the condition of the site deteriorates through overgrazing, Idaho fescue loses vigor and decreases in extent. Bluebunch wheatgrass, snowberry, and forbs increase in extent. Bluegrasses invade. If deterioration continues, the extent of bluebunch wheatgrass decreases and annual grasses and forbs strongly invade the site.

Mechanical treatment for range seeding is not practical because of the slope. The very cobbly surface layer also is a limitation on the Snell unit. Brush control is not advisable because of the value of chokecherry, hawthorn, and other deciduous shrubs on this unit for wildlife food and cover.

The Snell soil is in the North 14-17pz range site. The Sag soil is in the Deep North 14-17pz range site.

158D—Snellby stony silt loam, 12 to 35 percent north slopes. This moderately deep, well drained soil is on hills. It formed in colluvium derived from basalt and influenced by volcanic ash and loess in the surface layer. Areas are irregular in shape and are 100 to 400 acres in size. The native vegetation is mainly bunchgrasses, forbs, and shrubs. Elevation is 3,400 to 3,800 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 41 to 45 degrees F, and the average frost-free period is 60 to 90 days.

Typically, the surface layer is dark brown stony silt loam about 6 inches thick. The next layer is dark brown stony silty clay loam about 4 inches thick. The upper part of the subsoil is dark yellowish brown very stony clay about 8 inches thick. The lower part is yellowish brown very stony silty clay loam. It extends to a depth of about 24 inches. The depth to bedrock is 20 to 40 inches.

Included in this unit are small areas of soils that are similar to the Snellby soil but are more than 40 inches deep over bedrock. Also included are small areas of Rock outcrop. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate to a depth of about 10 inches in the Snellby soil and slow below that depth. Available water capacity is 2 to 5 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 mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on this unit is dominated by Idaho fesuce and Wyoming big sagebrush.

Idaho fescue is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 1,700 pounds per acre in favorable years and 600 pounds per acre in unfavorable years. Livestock access is limited by the stony surface layer.

If the condition of the site deteriorates through overgrazing, Idaho fescue loses vigor and decreases in extent. Sandberg bluegrass and Wyoming big sagebrush increase in extent. If deterioration continues, annual grasses and forbs invade the site.

Mechanical treatment for brush control and range seeding is not practical because of the stones on the surface.

The Snellby soil is in the Mountain North 9-12pz range site.

158E—Snellby stony silt loam, 35 to 50 percent north slopes. This moderately deep, well drained soil is on hills. It formed in colluvium derived from basalt and influenced by volcanic ash and loess in the surface layer. Areas are irregular in shape and are 100 to 400 acres in size. The native vegetation is mainly bunchgrasses, forbs, and shrubs. Elevation is 3,400 to 3,800 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 41 to 45 degrees F, and the average frost-free period is 60 to 90 days.

Typically, the surface layer is dark brown stony silt loam about 6 inches thick. The next layer is dark brown stony silty clay loam about 4 inches thick. The upper part of the subsoil is dark yellowish brown very stony clay about 8 inches thick. The lower part is yellowish brown very stony silty clay loam. It extends to a depth of about 24 inches. The depth to bedrock is 20 to 40 inches.

Included in this unit are small areas of soils that are similar to the Snellby soil but are more than 40 inches deep over bedrock. Also included are small areas of Rock outcrop. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate to a depth of about 10 inches in the Snellby soil and slow below that depth. Available water capacity is 2 to 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 mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on this unit is dominated by Idaho fesuce and Wyoming big sagebrush.

Idaho fescue is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 1,700 pounds per acre in favorable years and 600 pounds per acre in unfavorable years. Livestock access is limited by the stony surface and the slope.

If the condition of the site deteriorates through overgrazing, Idaho fescue loses vigor and decreases in extent. Sandberg bluegrass and Wyoming big sagebrush increase in extent. If deterioration continues, annual grasses and forbs invade the site.

Mechanical treatment for brush control and range seeding is not practical because of the stony surface layer and the slope.

The Snellby soil is in the Mountain North 9-12pz range site.

159A—Stanflow-Umapine silt loams, 0 to 2 percent slopes. This map unit is on low terraces. Areas are irregular in shape and are 20 to 200 acres in size. The native vegetation is mainly salt-tolerant grasses and shrubs. Elevation is 2,000 to 3,500 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 110 to 140 days.

This unit is about 50 percent Stanflow silt loam and 35 percent Umapine silt loam. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

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

The Stanflow soil is moderately well drained. It is moderately deep to a weakly cemented hardpan. It formed in mixed alluvium influenced by volcanic ash in the surface layer. Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. The upper part of the subsoil is dark grayish brown silt loam about 13 inches thick. The next part is a weakly cemented hardpan about 7 inches thick. The lower part to a depth of 60 inches or more is dark grayish brown loam and silt loam.

Permeability is moderate in the upper part of the Stanflow soil and slow in the weakly cemented layer. Available water capacity is 8 to 10 inches. The effective rooting depth is limited by a seasonal high water table at a depth of 2 to 4 feet in winter and spring. Runoff is slow, and the hazard of water erosion is slight.

The Umapine soil is deep and somewhat poorly drained. It formed in mixed alluvium influenced by loess and volcanic ash. Typically, the surface layer is brownish gray silt loam about 12 inches thick. The subsoil is grayish brown and brown silt loam about 28 inches thick. The substratum to a depth of 60 inches or more is brown silt loam.

Permeability is moderate in the Umapine soil. Available water capacity is 10 to 13 inches. Runoff is slow, and the hazard of water erosion is slight. The effective rooting depth is limited by a seasonal high water table at a depth of 1 to 2 feet in winter and spring. This soil is subject to rare flooding.

This unit is used mainly for irrigated hay and pasture. It also provides habitat for many kinds of wildlife.

Hay and pasture.—If this unit is used for hay and pasture, the main limitations are the high amount of salts in the surface layer, the seasonal high water table, and the weakly cemented hardpan in the Stanflow soil.

The concentration of salts in the surface layer limits the production of plants suitable for hay and pasture. Leaching of the salts from the surface layer is limited by the high water table. A drainage system and good management of irrigation water minimize the concentration of salts. Salt-tolerant species should be selected for planting. Ripping and shattering the hardpan increase the effective rooting depth and improve internal drainage of the Stanflow soil.

Periodic mowing and clipping help to maintain uniform growth and prevent selective grazing. Proper grazing practices, weed control, and fertilizer are needed to ensure maximum quality of forage.

Conducting fieldwork during wet periods results in deterioration of tilth and destroys soil structure. As a result, it increases the runoff rate. Grazing during wet periods results in compaction of the surface layer.

Compaction limits the movement of air in the soil and restricts the growth of roots.

Because of salt concentrations, the selection of trees and shrubs that can be grown as windbreaks and environmental plantings is limited and seedling mortality is severe. The species selected for planting should be those that can withstand excess moisture. Spring planting may be delayed because of the excess moisture.

The Stanflow and Umapine soils are in the Sodic Bottom range site.

160E—Stavely coarse sandy loam, 20 to 50 percent south slopes. This deep, well drained soil is on mountains. It formed in colluvium and residuum derived from rhyolite and andesite tuff. Areas are irregular in shape and are 40 to 100 acres in size. The native vegetation is mainly conifers, shrubs, bunchgrasses, and forbs. Elevation is 4,000 to 6,000 feet. The average annual precipitation is 20 to 30 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 60 to 90 days.

Typically, the surface layer is very dark grayish brown coarse sandy loam about 11 inches thick. The subsoil is very dark grayish brown gravelly coarse sandy loam about 15 inches thick. The substratum to a depth of 60 inches or more is light brownish gray gravelly coarse sandy loam and very gravelly loamy coarse sand.

Included in this unit are small areas of Segundo soils. Also included are small areas of Anatone and Baldridge soils. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderately rapid in the Stavely soil. Available water capacity is 3 to 6 inches. The effective rooting depth is 60 inches or more. Runoff is medium or rapid, and the hazard of water erosion is moderate or high.

This unit is used mainly for timber production. It also is used for livestock grazing, and it provides habitat for many kinds of wildlife.

Woodland.—This unit is suited to the production of ponderosa pine and Douglas-fir. The mean site index is 67 for ponderosa pine (100-year base age) and 59 for Douglas-fir (50-year base age). The potential production at culmination of the mean annual increment for ponderosa pine is 52 cubic feet per acre per year (3.6 cubic meters per hectare per year) in a 50-year-old, even-aged, fully stocked stand and for Douglas-fir is 42 cubic feet per acre per year (2.9 cubic meters per hectare per year) in a 111-year-old, even-aged, fully stocked stand.

The main concerns in producing and harvesting timber are the hazard of erosion, the equipment limitation, seedling mortality, plant competition, and fire damage to the soil.

Minimizing the risk of erosion is essential in areas where timber is harvested. Properly designed road drainage systems that include carefully located culverts help to control erosion. Spoil from excavations is subject to rill and gully erosion and to sloughing. Roads, landings, skid trails, and firebreaks can be protected against erosion by constructing water bars and by seeding areas that have been cut and filled. Buffer strips may be needed in areas adjacent to perennial streams to minimize siltation and maintain stream temperatures.

The slope restricts the use of wheeled and tracked equipment. Cable yarding systems that fully or partially suspend the logs above the ground cause less damage to the soil than conventional ground-based systems and reduce the risk of compaction. The risk of compaction also can be reduced by using suitable harvesting methods, laying out skid trails in advance, and harvesting timber when the soil is dry or frozen.

Careful management of reforestation is needed to minimize competition from undesirable plants. If the site is not adequately prepared, plant competition can prevent or delay the reestablishment of volunteer or planted trees. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying. Scarification is severely restricted in the steeper areas because of increased expense and soil displacement.

The seedling mortality rate is increased by compaction of the surface layer and by droughtiness in the surface layer. Shading and mulching of seedlings may be required. The trees that are suitable for planting include ponderosa pine.

Decline in forest productivity is likely to result from fire of moderate intensity.

Grazable woodland.—This unit is suitable for use as grazable woodland. The understory consists mainly of common snowberry, spirea, low Oregongrape, elk sedge, pinegrass, and strawberry. The potential production of the native understory plants in a normal year is about 800 pounds of air-dry forage per acre.

A system that results in proper grazing use is essential if livestock graze this unit. Timely deferment of grazing is needed to allow the desirable plants to mature and set seed. Grazing should be delayed in spring until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.

Seeding disturbed areas to suitable plants reduces the hazard of erosion and provides forage for livestock and wildlife. Deferred grazing is needed during periods when seedlings are becoming established.

This soil can produce adequate forage for big game animals after the tree canopy is opened by logging, fire, or some other disturbance. Stands of timber should be left in some areas to provide escape and thermal cover for the big game animals.

The Stavely soil is in the Pine-Fir-Sedge woodland understory site.

161E—Stices gravelly loam, 35 to 50 percent north slopes. This deep, well drained soil is on mountains. It formed in colluvium derived from rhyolite and andesite and has a mantle of volcanic ash. Areas are irregular in shape and are 80 to 400 acres in size. The native vegetation is mainly conifers, shrubs, bunchgrasses, and forbs. Elevation is 4,000 to 6,000 feet. The average annual precipitation is 20 to 35 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 30 to 60 days.

Typically, the surface layer is dark brown gravelly loam about 3 inches thick. The subsoil is dark brown and dark yellowish brown very gravelly loam about 18 inches thick. The substratum to a depth of 60 inches or more is brown and multicolored extremely gravelly sandy loam and loamy sand. The mantle of volcanic ash is 14 to 30 inches thick. The depth to bedrock is typically more than 60 inches but is 40 to 60 inches in some areas.

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

Permeability is moderately rapid in the Stices soil. Available water capacity is 4 to 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 mainly for timber production. It also is used for livestock grazing, and it provides habitat for many kinds of wildlife.

Woodland.—This unit is suited to the production of Douglas-fir. The mean site index is 53 for Douglas-fir (50-year base age). The potential production at culmination of the mean annual increment for Douglas-fir is 34 cubic feet per acre per year (2.4 cubic meters per hectare per year) in a 114-year-old, even-aged, fully stocked stand.

The main concerns in producing and harvesting timber are the hazard of erosion, the equipment limitation, seedling mortality, plant competition, and fire damage to the soil.

Minimizing the risk of erosion is essential in areas where timber is harvested. Properly designed road drainage systems that include carefully located culverts help to control erosion. Spoil from excavations is subject to rill and gully erosion and to sloughing. Roads, landings, skid trails, and firebreaks can be protected against erosion by constructing water bars and by seeding areas that have been cut and filled. Buffer strips may be needed in areas adjacent to perennial streams to minimize siltation and maintain stream temperatures.

The slope restricts the use of wheeled and tracked equipment. High-lead or other logging systems that fully or partially suspend the logs above the ground cause less damage to the soil than tractor systems and reduce the risk of compaction.

Careful management of reforestation is needed to minimize competition from undesirable plants. If the site is not adequately prepared, plant competition can prevent or delay the reestablishment of volunteer or planted trees. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying. Scarification is less suitable in the steeper areas because of increased expense and soil displacement.

The high content of rock fragments limits seedling survival. To compensate for the higher expected mortality rate, larger seedlings or a greater number of seedlings than is typical can be planted. The trees that are suitable for planting include Douglas-fir and western larch.

Decline in forest productivity is likely to result from fire of moderate intensity.

Grazable woodland.—This unit is suitable for use as grazable woodland. The understory consists mainly of princes pine, myrtle pachystima, elk sedge, heartleaf arnica, pyrola, and western rattlesnake plantain.

A system that results in proper grazing use is essential if livestock graze this unit. Timely deferment of grazing is needed to allow the desirable plants to mature and set seed. Grazing should be delayed in spring until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.

Seeding disturbed areas to suitable plants reduces the hazard of erosion and provides forage for livestock and wildlife. Deferred grazing is needed during periods when seedlings are becoming established.

This soil can produce adequate forage for big game animals after the tree canopy is opened by logging, fire, or some other disturbance. Dense stands of timber should be left in some areas to provide escape and thermal cover for the big game animals.

The Stices soil is in the Mixed Fir-Princes Pine woodland understory site.

161F—Stices gravelly loam, 50 to 80 percent north slopes. This deep, well drained soil is on mountains. It formed in colluvium derived from rhyolite and andesite and has a mantle of volcanic ash. Areas are irregular in shape and are 80 to 400 acres in size. The native vegetation is mainly conifers, shrubs, bunchgrasses, and forbs. Elevation is 4,000 to 6,000 feet. The average annual precipitation is 20 to 35 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 30 to 60 days.

Typically, the surface layer is dark brown gravelly loam about 3 inches thick. The subsoil is dark brown and dark yellowish brown very gravelly loam about 18 inches thick. The substratum to a depth of 60 inches or more is brown and multicolored extremely gravelly sandy loam and loamy sand. The mantle of volcanic ash is 14 to 30 inches thick. The depth to bedrock is typically more than 60 inches but is 40 to 60 inches in some areas.

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

Permeability is moderately rapid in the Stices soil. Available water capacity is 4 to 6 inches. The effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is very high.

This unit is used mainly for timber production. It also provides habitat for many kinds of wildlife.

Woodland.—This unit is suited to the production of Douglas-fir. The mean site index is 53 for Douglas-fir (50-year base age). The potential production at culmination of the mean annual increment for Douglas-fir is 34 cubic feet per acre per year (2.4 cubic meters per hectare per year) in a 114-year-old, even-aged, fully stocked stand.

The main concerns in producing and harvesting timber are the hazard of erosion, the equipment limitation, seedling mortality, plant competition, and fire damage to the soil.

Minimizing the risk of erosion is essential in areas where timber is harvested. Properly designed road drainage systems that include carefully located culverts help to control erosion. Spoil from excavations is subject to rill and gully erosion and to sloughing. Roads, landings, skid trails, and firebreaks can be protected against erosion by constructing water bars and by seeding areas that have been cut and filled. Buffer strips may be needed in areas adjacent to perennial streams to minimize siltation and maintain stream temperatures.

The slope prevents the use of wheeled and tracked equipment. High-lead or other logging systems that fully suspend the logs above the ground cause less damage to the soil than other systems. The risk of compaction can be reduced by using suitable harvesting methods and by harvesting when the soil is dry or frozen.

Careful management of reforestation is needed to minimize competition from undesirable plants. If the site is not adequately prepared, plant competition can prevent or delay the reestablishment of volunteer or planted trees. Competing weeds, brush, or trees can be controlled by spraying, cutting, or girdling.

The high content of rock fragments limits seedling survival. To compensate for the higher expected mortality rate, larger seedlings or a greater number of seedlings than is typical can be planted. The trees that are suitable for planting include Douglas-fir and western larch.

Decline in forest productivity is likely to result from fire of moderate intensity.

The understory consists mainly of princes pine, myrtle pachystima, elk sedge, heartleaf arnica, pyrola, and western rattlesnake plantain.

This soil can produce adequate forage for big game animals after the tree canopy is opened by logging, fire, or some other disturbance. Dense stands of timber should be left in some areas to provide escape and thermal cover for the big game animals.

The Stices soil is in the Mixed Fir-Princes Pine woodland understory site.

162A—Sumpley-Stovepipe silt loams, 0 to 3 percent slopes. This map unit is on flood plains. Areas are irregular in shape and are 20 to 200 acres in size. The native vegetation is mainly water-tolerant grasses, rushes, and sedges. Elevation is 3,800 to 4,200 feet. The average annual precipitation is 16 to 24 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 50 to 90 days.

This unit is about 50 percent Sumpley silt loam and 35 percent Stovepipe silt loam. The Sumpley soil is in a slightly higher convex position, and the Stovepipe soil is in depressions. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

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

The Sumpley soil is deep, and somewhat poorly drained. It formed in mixed alluvium influenced by loess and volcanic ash in the surface layer. Typically, the surface layer is very dark gray silt loam about 7 inches thick. The next layer is very dark grayish brown silt loam about 7 inches thick. The subsoil is dark grayish brown loam about 20 inches thick. The substratum to a depth of 60 inches or more is dark gray extremely gravelly loamy sand and generally is gleyed. Depth to the extremely gravelly substratum is 20 to 40 inches.

Permeability is moderate to a depth of about 34 inches in the Sumpley soil and rapid below that depth. Available water capacity is 5 to 8 inches. The effective rooting depth is limited by a seasonal high water table at a depth of 1 to 2 feet in spring and early summer. This soil is occasionally flooded for very brief periods in spring and early summer. Runoff is slow to ponded, and the hazard of water erosion is slight.

The Stovepipe soil is deep, and poorly drained. It formed in mixed alluvium influenced by loess and volcanic ash in the surface layer. Typically, the surface layer is black silt loam about 13 inches thick. The subsoil is gray silt loam about 11 inches thick. The upper 9 inches of the substratum is dark gray extremely gravelly loamy sand. The lower part to a depth of 60 inches or more is multicolored extremely gravelly sand. The substratum generally is gleyed. Depth to the extremely gravelly substratum is 20 to 40 inches.

Permeability soil is moderate to a depth of about 24 inches in the Stovepipe soil and rapid below that depth. Available water capacity is 5 to 7 inches. The effective rooting depth is limited by a seasonal high water table at a depth of 0.5 foot to 1.5 feet in spring and early summer. This soil is occasionally flooded for brief periods in spring and early summer. Runoff is slow to ponded, and the hazard of water erosion is slight.

This unit is used mainly for irrigated hay and pasture. It also provides habitat for many kinds of wildlife.

Hay and pasture.—If this unit is used for hay and pasture, the main limitation is the seasonal high water table. Wetness limits the choice of plants and the period of cutting or grazing and increases the risk of winterkill.

Grazing during wet periods results in compaction of the surface layer, poor tilth, and excessive runoff. Conducting fieldwork during wet periods results in deterioration of tilth and destroys soil structure. As a result, it increases the runoff rate and the hazard of erosion. Compaction limits the movement of air and water in the soil and restricts the growth of roots.

Fertilizer is needed to ensure the optimum growth of grasses and legumes.

In summer irrigation is needed for the maximum production of hay. Controlled surface irrigation is a suitable method of applying water. Leveling helps to ensure the uniform application of water. To avoid 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.

Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and control erosion. Periodic mowing and clipping help to maintain uniform growth, prevent selective grazing, and reduce clumpy growth.

This unit is generally unsuited to the trees and shrubs grown as windbreaks and environmental plantings. Onsite investigation is needed to identify areas where trees and shrubs can be planted if special management is applied.

The Sumpley soil is in the Mountain Meadow range site. The Stovepipe soil is in the Wet Mountain Meadow range site.

163D—Taterpa loam, 12 to 35 percent north slopes. This deep, well drained soil is on hills and mountains. It formed in colluvium and residuum derived from quartz diorite and related granitic rocks. Areas are irregular in shape and are 100 to 400 acres in size. The native vegetation is mainly bunchgrasses, shrubs, and forbs. Elevation is 4,000 to 6,200 feet. The average annual precipitation is 16 to 20 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 60 to 90 days.

Typically, the surface layer is black loam about 13 inches thick. The subsoil is very dark brown loam about 21 inches thick. The substratum is dark brown gravelly sandy loam about 15 inches thick. The depth to weathered bedrock is 40 to 60 inches.

Included in this unit are small areas of soils that are similar to the Taterpa soil but are less than 40 inches deep over bedrock. Also included are small areas of Bouldrock and Brownlee soils. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate to a depth of about 13 inches in the Taterpa soil and moderately rapid below that depth. Available water capacity is 5 to 7 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 livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on this unit is dominated by Idaho fescue, mountain big sagebrush, and needlegrass.

Idaho fescue is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 2,200 pounds per acre in favorable years and 1,400 pounds per acre in unfavorable years.

If the condition of the site deteriorates through overgrazing, Idaho fescue loses vigor and decreases in extent. Mountain big sagebrush, buckwheat, and blue wildrye increase in extent. If deterioration continues, annual forbs and grasses invade the site.

Water developments, such as livestock watering ponds, are limited by the hazard of seepage.

The Taterpa soil is in the Shrubby Mountain North 16-20pz range site.

163E—Taterpa loam, 35 to 60 percent north slopes. This deep, well drained soil is on hills and mountains. It formed in colluvium and residuum derived from quartz diorite and related granitic rocks. Areas are irregular in shape and are 100 to 400 acres in size. The native vegetation is mainly bunchgrasses, shrubs, and forbs. Elevation is 4,000 to 6,200 feet. The average annual precipitation is 16 to 20 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 60 to 90 days.

Typically, the surface layer is black loam about 13 inches thick. The subsoil is very dark brown loam about 21 inches thick. The substratum is dark brown gravelly sandy loam about 15 inches thick. The depth to weathered bedrock is 40 to 60 inches.

Included in this unit are small areas of soils that are similar to the Taterpa soil but are less than 40 inches deep over bedrock. Also included are small areas of Bouldrock soils and Rock outcrop. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate to a depth of about 13 inches in the Taterpa soil and moderately rapid below that depth. Available water capacity is 5 to 7 inches. The effective rooting depth is 40 to 60 inches. Runoff is rapid, and the hazard of water erosion is high or very high.

This unit is used mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on this unit is dominated by Idaho fescue, mountain big sagebrush, and needlegrass.

Idaho fescue is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 2,200 pounds per acre in favorable years and 1,400 pounds per acre in unfavorable years. Livestock access is limited by the slope.

If the condition of the site deteriorates through overgrazing, Idaho fescue loses vigor and decreases in extent. Mountain big sagebrush, buckwheat, and blue wildrye increase in extent. If deterioration continues, annual forbs and grasses invade the site.

Mechanical treatment for brush control and range seeding is not practical because of the slope. Water developments, such as livestock watering ponds, are limited because of the hazard of seepage.

The Taterpa soil is in the Shrubby Mountain North 16-20pz range site.

164D—Tolo-Crackler complex, 12 to 35 percent north slopes. This map unit is on mountains. Areas are irregular in shape and are 100 to 400 acres in size. The native vegetation is mainly conifers, shrubs, and grasses. Elevation is 3,800 to 5,000 feet. The average annual precipitation is 20 to 35 inches, the average annual air temperature is 42 to 45 degrees F, and the average frost-free period is 30 to 50 days.

This unit is about 50 percent Tolo silt loam and 40 percent Crackler gravelly silt loam. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of Dogtown gravelly loam. Also included are small areas of soils that are similar to the Tolo and Crackler soils but are less than 40 inches deep over bedrock. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

The Tolo soil is deep and well drained. It formed in volcanic ash over older loamy mixed colluvium. Typically, the surface is covered with a mat of partially decomposed needles, leaves, and twigs about 2 inches thick. The surface layer is very dark grayish brown and dark brown silt loam about 15 inches thick. The upper part of the subsoil is dark brown silt loam about 14 inches thick. The lower part is dark brown gravelly sandy clay loam about 20 inches thick. The substratum is brown gravelly sandy loam about 11 inches thick. The depth to bedrock is typically 60 inches or more but is 40 to 60 inches in some areas. The mantle of volcanic ash is 20 to 30 inches thick.

Permeability is moderate to a depth of about 29 inches in the Tolo soil and moderately slow below that depth. Available water capacity is 9 to 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 Crackler soil is deep and well drained. It formed in colluvium derived from argillite and influenced by volcanic ash in the surface layer. Typically, the surface is covered with a mat of partially decomposed needles, grass, and twigs about 1 inch thick. The surface layer is dark brown and brown gravelly silt loam about 17 inches thick. The upper part of the subsoil is brown very cobbly silty clay loam about 17 inches thick. The lower part is dark yellowish brown extremely gravelly clay loam about 9 inches thick. The depth to bedrock is 40 to 60 inches.

Permeability is moderate to a depth of about 17 inches in the Crackler soil and moderately slow below that depth. Available water capacity is 6 to 11 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. It also is used for livestock grazing, and it provides habitat for many kinds of wildlife.

Figure 12.—Erosion in an area of Tolo-Crackler complex, 12 to 35 percent north slopes, after a forest fire.

Woodland.—The Tolo soil is suited to the production of Douglas-fir and ponderosa pine. The mean site index is 60 for Douglas-fir (50-year base age) and 75 for ponderosa pine (100-year base age). The potential production at culmination of the mean annual increment for Douglas-fir is 44 cubic feet per acre per year (3.1 cubic meters per hectare per year) in a 110-year-old, even-aged, fully stocked stand and for ponderosa pine is 62 cubic feet per acre per year (4.3 cubic meters per hectare per year) in a 50-year-old, even-aged, fully stocked stand.

The Crackler soil is suited to the production of Douglas-fir and grand fir. The mean site index is 68 for Douglas-fir (50-year base age) and 58 for grand fir (50-year base age). The potential production at culmination of the mean annual increment for Douglas-fir is 58 cubic feet per acre per year (4.1 cubic meters per hectare per year) in a 104-year-old, even-aged, fully stocked stand and for grand fir is 72 cubic feet per acre per year (5.0 cubic meters per hectare per year) in a 120-year-old, even-aged, fully stocked stand.

The main concerns in producing and harvesting timber are the hazard of erosion, the equipment limitation, plant competition, and the hazard of windthrow on the Crackler soil.

Minimizing the risk of erosion is essential in areas where timber is harvested (fig. 12). Properly designed road drainage systems that include carefully located culverts help to control erosion. Spoil from excavations is subject to rill and gully erosion and to sloughing. Roads, landings, skid trails, and firebreaks can be protected against erosion by constructing water bars and by seeding areas that have been cut and filled. Buffer strips may be needed in areas adjacent to perennial streams to minimize siltation and maintain stream temperatures.

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. The risk of compaction can be reduced by using low-pressure ground equipment, laying out skid trails in advance, and harvesting timber when the soil is dry or frozen. Compaction limits the movement of water and air in the soil and restricts the growth of roots. Cable yarding systems that partially or fully suspend logs generally do less damage to the soil than conventional ground-based systems.

Careful management of reforestation is needed to minimize competition from undesirable plants. If the site is not adequately prepared, plant competition can prevent or delay the reestablishment of volunteer or planted trees. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying. The trees that are suitable for planting include Douglas-fir and ponderosa pine.

Trees on the Crackler soil are subject to windthrow during periods when the soil is excessively wet and winds are strong. Regeneration systems that isolate single trees or groups of trees are not practical because of the hazard of windthrow.

Grazable woodland.—This unit is suitable for use as grazable woodland. The understory consists mainly of princes pine, myrtle pachystima, elk sedge, heartleaf arnica, pyrola, and western rattlesnake plantain.

A system that results in proper grazing use is essential if livestock graze this unit. Timely deferment of grazing is needed to allow the desirable plants to mature and set seed. Grazing should be delayed in spring until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.

Seeding disturbed areas to suitable plants increases forage production. Deferred grazing is needed during periods when seedlings are becoming established.

This soil can produce adequate forage for big game animals after the tree canopy is opened by logging, fire, or some other disturbance. Dense stands of timber should be left in some areas to provide escape and thermal cover for the big game animals.

The Tolo soil is in the Fir-Pine-Sedge (bedrock) woodland understory site. The Crackler soil is in the Mixed Fir-Princes Pine woodland understory site.

165D—Tolo-Dogtown complex, 12 to 35 percent north slopes. This map unit is on mountains. Areas are irregular in shape and are 100 to 400 acres in size. The native vegetation is mainly conifers, shrubs, and grasses. Elevation is 3,800 to 5,000 feet. The average annual precipitation is 20 to 35 inches, the average annual air temperature is 42 to 45 degrees F, and the average frost-free period is 30 to 50 days.

This unit is about 50 percent Tolo silt loam and 40 percent Dogtown gravelly loam. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of Dogtown very stony loam. Also included are small areas of soils that are similar to the Tolo and Dogtown soils but are less than 40 inches deep over bedrock and small areas of Tolo soils on slopes less than 12 percent. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

The Tolo soil is deep and well drained. It formed in volcanic ash over older loamy mixed colluvium. Typically, the surface is covered with a mat of partially decomposed needles, leaves, and twigs about 2 inches thick. The surface layer is very dark grayish brown and dark brown silt loam about 15 inches thick. The upper part of the subsoil is dark brown silt loam about 14 inches thick. The lower part is dark brown gravelly sandy clay loam about 20 inches thick. The substratum is brown gravelly sandy loam about 11 inches thick. The depth to bedrock is typically 60 inches or more but is 40 to 60 inches in some areas. The mantle of volcanic ash is 20 to 30 inches thick.

Permeability is moderate to a depth of about 29 inches in the Tolo soil and moderately slow below that depth. Available water capacity is 9 to 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 Dogtown soil is deep and well drained. It formed in colluvium and residuum derived from quartz diorite and related granitic rocks and influenced by volcanic ash in the surface layer. Typically, the surface layer is covered with a mat of partially decomposed needles, grass, and moss about 2 inches thick. The surface layer is very dark grayish brown and dark brown gravelly loam about 11 inches thick. The subsoil is dark brown and brown very gravelly sandy loam about 30 inches thick. The substratum is brown very gravelly loamy sand about 16 inches thick. The depth to weathered bedrock is typically 60 inches or more.

Permeability is moderate to a depth of about 28 inches in Dogtown gravelly loam and moderately rapid below that depth. Available water capacity is 4 to 7 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 mainly for timber production. It also is used for livestock grazing, and it provides habitat for many kinds of wildlife.

Woodland.—The Tolo soil is suited to the production of Douglas-fir and ponderosa pine. The mean site index is 60 for Douglas-fir (50-year base age) and 75 for ponderosa pine (100-year base age). The potential production at culmination of the mean annual increment for Douglas-fir is 44 cubic feet per acre per year (3.1 cubic meters per hectare per year) in a 110-year-old, even-aged, fully stocked stand and for ponderosa pine is 62 cubic feet per acre per year (4.3 cubic meters per hectare per year) in a 50-year-old, even-aged, fully stocked stand.

The Dogtown soil is suited to the production of Douglas-fir and ponderosa pine. The mean site index is 61 for Douglas-fir (50-year base age) and 83 for ponderosa pine (100-year base age). The potential production at culmination of the mean annual increment for Douglas-fir is 46 cubic feet per acre per year (3.2 cubic meters per hectare per year) in a 109-year-old, even-aged, fully stocked stand and for ponderosa pine is 74 cubic feet per acre per year (5.2 cubic meters per hectare per year) in a 40-year-old, even-aged, fully stocked stand.

The main concerns in producing and harvesting timber are the hazard of erosion, the equipment limitation, plant competition, and seedling mortality on the Dogtown soil.

Minimizing the risk of erosion is essential in areas where timber is harvested. Properly designed road drainage systems that include carefully located culverts help to control erosion. Spoil from excavations is subject to rill and gully erosion and to sloughing. Roads, landings, skid trails, and firebreaks can be protected against erosion by constructing water bars and by seeding areas that have been cut and filled. Buffer strips may be needed in areas adjacent to perennial streams to minimize siltation and maintain stream temperatures.

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. The risk of compaction can be reduced by using low-pressure ground equipment, laying out skid trails in advance, and harvesting timber when the soil is dry or frozen. Cable yarding systems that partially or fully suspend logs generally do less damage to the soil than conventional ground-based systems.

Careful management of reforestation is needed to minimize competition from undesirable plants. If the site is not adequately prepared, plant competition can prevent or delay the reestablishment of volunteer or planted trees. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying.

The seedling mortality rate is increased by compaction of the surface layer because compaction limits the movement of water and air in the soil and restricts the growth of roots.

The high content of rock fragments limits seedling survival. To compensate for the higher expected mortality rate, larger seedlings or a greater number of seedlings than is typical can be planted. The trees that are suitable for planting include Douglas-fir, ponderosa pine, and western larch.

Grazable woodland.—This unit is suitable for use as grazable woodland. The understory on the Tolo soil consists mainly of princes pine, myrtle pachystima, elk sedge, heartleaf arnica, pyrola, and western rattlesnake plantain.

The understory on the Dogtown soil consists mainly of princes pine, low Oregongrape, myrtle pachystima, elk sedge, pine grass, and heartleaf arnica.

A system that results in proper grazing use is essential if livestock graze this unit. Timely deferment of grazing is needed to allow the desirable plants to mature and set seed. Grazing should be delayed in spring until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.

Seeding disturbed areas to suitable plants increases forage production. Deferred grazing is needed during periods when seedlings are becoming established.

This soil can produce adequate forage for big game animals after the tree canopy is opened by logging, fire, or some other disturbance. Dense stands of timber should be left in some areas to provide escape and thermal cover for the big game animals.

The Tolo soil is in the Fir-Pine-Sedge (bedrock) woodland understory site. The Dogtown soil is in the Fir-Pine-Sedge woodland understory site.

166D—Top silt loam, 12 to 35 percent north slopes. This deep, well drained soil is on mountains. It formed in loess and in colluvium derived from basalt. Areas are irregular in shape and are 100 to 400 acres in size. The native vegetation is mainly conifers. Elevation is 3,300 to 5,000 feet. The average annual precipitation is 20 to 30 inches, the average annual air temperature is 40 to 45 degrees F, and the frost-free period is 60 to 90 days.

Typically, the surface layer is very dark grayish brown and dark brown silt loam about 9 inches thick. The upper 11 inches of the subsoil is dark brown silty clay loam. The next layer is dark reddish brown cobbly clay. It extends to a depth of about 39 inches. The lower part of the subsoil is dark reddish brown silty clay loam about 9 inches thick. The depth to bedrock is 40 to 60 inches.

Included in this unit are small areas of Klicker and Applegate soils. Also included are small areas of soils that are similar to the Top soil but are more than 60 inches deep over bedrock. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate to a depth of about 9 inches in the Top soil and moderately slow below that depth. Available water capacity is 6 to 10 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. It also is used for livestock grazing, and it provides habitat for many kinds of wildlife.

Woodland.—The Top soil is suited to the production of ponderosa pine and Douglas-fir. The mean site index is 111 for ponderosa pine (100-year base age) and 83 for Douglas-fir (50-year base age). The potential production at culmination of the mean annual increment for ponderosa pine is 124 cubic feet per acre per year (8.7 cubic meters per hectare per year) in a 40-year-old, even-aged, fully stocked stand and for Douglas-fir is 88 cubic feet per acre per year (6.2 cubic meters per hectare per year) in a 95-year-old, even-aged, fully stocked stand.

The main concerns in producing and harvesting timber are the hazard of erosion, the equipment limitation, plant competition, and fire damage to the soil.

Minimizing the risk of erosion is essential in forest management. The hazard of erosion can be reduced by carefully planning the construction and maintenance of logging roads, skid trails, and landings. Properly designed road drainage systems that include carefully located culverts help to control erosion. Because spoil from excavations is subject to rill and gully erosion and to sloughing, it should be seeded to permanent plant cover. Roads, landings, skid trails, and firebreaks can be protected against erosion by constructing water bars and by seeding areas that have been cut and filled. Buffer strips may be needed in areas adjacent to perennial streams to minimize siltation and maintain stream temperatures.

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. The risk of compaction can be reduced by using low-pressure ground equipment, laying out skid trails in advance, and harvesting timber when the soil is dry or frozen. Compaction limits the movement of water and air in the soil and restricts the growth of roots. Cable yarding systems that partially or fully suspend logs generally do less damage to the soil than ground-based systems.

Careful management of reforestation is needed to minimize competition from undesirable plants. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying. The trees that are suitable for planting include ponderosa pine and Douglas-fir.

Some decline in forest productivity may result from fire of moderate intensity.

Grazable woodland.—This unit is suitable for use as grazable woodland. The understory consists mainly of creambush oceanspray, mallow ninebark, Rocky Mountain maple, Saskatoon serviceberry, princes pine, and brackenfern.

A system that results in proper grazing use is essential if livestock graze this unit. Timely deferment of grazing is needed to allow the desirable plants to mature and set seed. Grazing should be delayed in spring until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.

Seeding disturbed areas to suitable plants reduces the hazard of erosion and provides forage for livestock and wildlife. Deferred grazing is needed during periods when seedlings are becoming established.

This soil can produce adequate forage for big game animals after the tree canopy is opened by logging, fire, or some other disturbance. Dense stands of timber should be left in some areas to provide escape and thermal cover for the big game animals.

The Top soil is in the Mixed Fir-Oceanspray woodland understory site.

166E—Top silt loam, 35 to 60 percent north slopes. This deep, well drained soil is on mountains. It formed in loess and in colluvium derived from basalt. Areas are irregular in shape and are 100 to 400 acres in size. The native vegetation is mainly conifers. Elevation is 3,300 to 5,000 feet. The average annual precipitation is 20 to 30 inches, the average annual air temperature is 40 to 45 degrees F, and the frost-free period is 60 to 90 days.

Typically, the surface layer is very dark grayish brown and dark brown silt loam about 9 inches thick. The upper 11 inches of the subsoil is dark brown silty clay loam. The next layer is dark reddish brown cobbly clay. It extends to a depth of about 39 inches. The lower part of the subsoil is dark reddish brown silty clay loam about 9 inches thick. The depth to bedrock is 40 to 60 inches.

Included in this unit are small areas of Klicker and McGarr soils. Also included are small areas of soils that are similar to the Top soil but have cobbles and stones on the surface. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate to a depth of about 9 inches in the Top soil and moderately slow below that depth. Available water capacity is 6 to 10 inches. The effective rooting depth is 40 to 60 inches. Runoff is rapid, and the hazard of water erosion is high or very high.

This unit is used mainly for timber production. It also provides habitat for many kinds of wildlife.

Woodland.—This unit is suited to the production of ponderosa pine and Douglas-fir. The mean site index is 111 for ponderosa pine (100-year base age) and 83 for Douglas-fir (50-year base age). The potential production at culmination of the mean annual increment for ponderosa pine is 124 cubic feet per acre per year (8.7 cubic meters per hectare per year) in a 40-year-old, even-aged, fully stocked stand and for Douglas-fir is 88 cubic feet per acre per year (6.2 cubic meters per hectare per year) in a 95-year-old, even-aged, fully stocked stand.

The main concerns in producing and harvesting timber are the hazard of erosion, the equipment limitation, plant competition, and fire damage to the soil.

Minimizing the risk of erosion is essential in forest management. The hazard of erosion can be reduced by carefully planning the construction and maintenance of logging roads, skid trails, and landings. Properly designed road drainage systems that include carefully located culverts help to control erosion. Because spoil from excavations is subject to rill and gully erosion and to sloughing, it should be seeded to permanent plant cover. Roads, landings, skid trails, and firebreaks can be protected against erosion by constructing water bars and by seeding areas that have been cut and filled. Buffer strips may be needed in areas adjacent to perennial streams to minimize siltation and maintain stream temperatures.

The slope restricts the use of wheeled and tracked equipment. Harvesting systems that lift the logs entirely off the ground maintain the understory vegetation and significantly reduce the risks of erosion and compaction. The risk of compaction also can be reduced by using cable yarding systems and harvesting timber when the soil is dry or frozen.

Careful management of reforestation is needed to minimize competition from undesirable plants. If the site is not adequately prepared, plant competition can prevent or delay the reestablishment of volunteer or planted trees. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying. Scarification is severely restricted in the steeper areas because of increased expense and soil displacement. The trees that are suitable for planting include ponderosa pine and Douglas-fir.

Some decline in forest productivity may result from fire of moderate intensity.

The understory consists mainly of creambush oceanspray, mallow ninebark, Rocky Mountain maple, Saskatoon serviceberry, princes pine, and brackenfern.

This soil can produce adequate forage for big game animals after the tree canopy is opened by logging, fire, or some other disturbance. Dense stands of timber should be left in some areas to provide escape and thermal cover for the big game animals.

The Top soil is in the Mixed Fir-Oceanspray woodland understory site.

167D—Top-McGarr complex, 12 to 35 percent north slopes. This map unit is on mountains. Areas are irregular in shape and are 100 to 400 acres in size. The native vegetation is mainly conifers, shrubs, and grasses. Elevation is 3,300 to 5,000 feet. The average annual precipitation is 20 to 30 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 30 to 60 days.

This unit is about 50 percent Top silt loam and 35 percent McGarr very stony loam. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of soils that are similar to the McGarr soil but are less than 20 inches deep over bedrock and small areas of Klicker soils. Also included are small areas of Top soils that have stones on the surface. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Top soil is deep and well drained. It formed in loess and in colluvium derived from basalt. Typically, the surface layer is very dark grayish brown and dark brown silt loam about 9 inches thick. The upper 11 inches of the subsoil is dark brown silty clay loam. The next layer is dark reddish brown cobbly clay. It extends to a depth of about 39 inches. The lower part of the subsoil is dark reddish brown silty clay loam about 9 inches thick. The depth to bedrock is 40 to 60 inches.

Permeability is moderate to a depth of about 9 inches in the Top soil and moderately slow below that depth. Available water capacity is 6 to 10 inches. The effective rooting depth is 40 to 60 inches. Runoff is medium, and the hazard of water erosion is moderate or high.

The McGarr soil is moderately deep and well drained. It formed in mixed volcanic ash, loess, and colluvium derived from andesite and basalt. Typically, the surface layer is very dark grayish brown very stony loam about 4 inches thick. The next layer is very dark grayish brown gravelly loam about 9 inches thick. The upper 9 inches of the subsoil is dark brown gravelly loam. The lower 7 inches is dark brown gravelly clay loam. The depth to bedrock is 20 to 40 inches.

Permeability is moderately slow in the McGarr soil. Available water capacity is 3 to 7 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 mainly for timber production. It also is used for livestock grazing, and it provides habitat for many kinds of wildlife.

Woodland.—The Top soil is suited to the production of ponderosa pine and Douglas-fir. The mean site index is 111 for ponderosa pine (100-year base age) and 83 for Douglas-fir (50-year base age). The potential production at culmination of the mean annual increment for ponderosa pine is 124 cubic feet per acre per year (8.7 cubic meters per hectare per year) in a 40-year-old, even-aged, fully stocked stand and for Douglas-fir is 88 cubic feet per year (6.2 cubic meters per hectare per year) in a 95-year-old, even-aged, fully stocked stand.

The McGarr soil is suited to the production of ponderosa pine. The mean site index is 68 for ponderosa pine (100-year base age). The potential production at culmination of the mean annual increment for ponderosa pine is 53 cubic feet per acre per year (3.7 cubic meters per hectare per year) in a 50-year-old, even-aged, fully stocked stand.

The main concerns in producing and harvesting timber are the hazard of erosion, the equipment limitation, seedling mortality, plant competition, the hazard of windthrow on the McGarr soil, and fire damage to the soil.

Minimizing the risk of erosion is essential in areas where timber is harvested. Properly designed road drainage systems that include carefully located culverts help to control erosion. Spoil from excavations is subject to rill and gully erosion and to sloughing. Roads, landings, skid trails, and firebreaks can be protected against erosion by constructing water bars and by seeding areas that have been cut and filled. Buffer strips may be needed in areas adjacent to perennial streams to minimize siltation and maintain stream temperatures.

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. The risk of compaction can be reduced by using low-pressure ground equipment, laying out skid trails in advance, and harvesting timber when the soil is dry or frozen. Stones on the surface of the McGarr soil can interfere with felling, yarding, and other activities involving the use of equipment. Cable yarding systems that partially or fully suspend logs generally do less damage to the soil than ground-based systems.

Careful management of reforestation is needed to minimize competition from undesirable plants. If the site is not adequately prepared, plant competition can prevent or delay the reestablishment of volunteer or planted trees. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying.

The seedling mortality rate is increased by compaction of the surface layer. A low available water capacity generally limits seedling survival on the McGarr soil in areas where understory plants are numerous. Shading and mulching of seedlings may be required on the McGarr soil. The trees that are suitable for planting include ponderosa pine and Douglas-fir.

Trees are subject to windthrow because of the limited rooting depth in the McGarr soil. Regeneration systems that isolate single trees or groups of trees are not practical because of the hazard of windthrow.

Some decline in forest productivity may result from fire of moderate intensity.

Grazable woodland.—This unit is suitable for use as grazable woodland. The understory on the Top soil consists mainly of creambush oceanspray, mallow ninebark, Rocky Mountain maple, Saskatoon serviceberry, princes pine, and brackenfern.

The understory on the McGarr soil consists mainly of common snowberry, spirea, elk sedge, pinegrass, Idaho fescue, and strawberry. The potential production of native understory on the McGarr soil in a normal year is about 800 pounds of air-dry forage per year.

A system that results in proper grazing use is essential if livestock graze this unit. Timely deferment of grazing is needed to allow the desirable plants to mature and set seed. Grazing should be delayed in spring until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.

Seeding disturbed areas to suitable plants reduces the hazard of erosion and provides forage for livestock and wildlife. Deferred grazing is needed during periods when seedlings are becoming established.

This unit can produce adequate forage for big game animals after the tree canopy is opened by logging, fire, or some other disturbance. Dense stands of timber should be left in some areas to provide escape and thermal cover for the big game animals.

The Top soil is in the Mixed Fir-Oceanspray woodland understory site. The McGarr soil is in the Pine-Snowberry-Sedge woodland understory site.

167E—Top-McGarr complex, 35 to 65 percent north slopes. This map unit is on mountains. Areas are irregular in shape and are 100 to 400 acres in size. The native vegetation is mainly conifers, shrubs, and grasses. Elevation is 3,300 to 5,000 feet. The average annual precipitation is 20 to 30 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 30 to 60 days.

This unit is about 50 percent Top silt loam and 35 percent McGarr very stony loam. The components of this unit occur as areas so intricately intermingled that mapping them separately was not practical at the selected scale.

Included in this unit are small areas of soils that are similar to the McGarr soil but are less than 20 inches deep over bedrock. Also included are areas of Top soils that have a stony surface layer. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Top soil is deep and well drained. It formed in loess and in colluvium derived from basalt. Typically, the surface layer is very dark grayish brown and dark brown silt loam about 9 inches thick. The upper 11 inches of the subsoil is dark brown silty clay loam. The next layer is dark reddish brown cobbly clay. It extends to a depth of about 39 inches. The lower part of the subsoil is dark reddish brown silty clay loam about 9 inches thick. The depth to bedrock is 40 to 60 inches.

Permeability is moderate to a depth of about 9 inches in the Top soil and moderately slow below that depth. Available water capacity is 6 to 10 inches. The effective rooting depth is 40 to 60 inches. Runoff is rapid, and the hazard of water erosion is high.

The McGarr soil is moderately deep and well drained. It formed in mixed volcanic ash, loess, and colluvium derived from andesite and basalt. Typically, the surface layer is very dark grayish brown very stony loam about 4 inches thick. The next layer is very dark grayish brown gravelly loam about 9 inches thick. The upper 9 inches of the subsoil is dark brown gravelly loam. The lower 7 inches is dark brown gravelly clay loam. The depth to bedrock is 20 to 40 inches.

Permeability is moderately slow in the McGarr soil. Available water capacity is 3 to 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 mainly for timber production. It also provides habitat for many kinds of wildlife.

Woodland.—The Top soil is suited to the production of ponderosa pine and Douglas-fir. The mean site index is 111 for ponderosa pine (100-year base age) and 83 for Douglas-fir (50-year base age). The potential production at culmination of the mean annual increment for ponderosa pine is 124 cubic feet per acre per year (8.7 cubic meters per hectare per year) in a 40-year-old, even-aged, fully stocked stand, and for Douglas-fir is 88 cubic feet per acre per year (6.2 cubic meters per hectare per year) in a 95-year-old, even-aged, fully stocked stand.

The McGarr soil is suited to the production of ponderosa pine. The mean site index is 68 for ponderosa pine (100-year base age). The potential production at culmination of the mean annual increment for ponderosa pine is 53 cubic feet per acre per year (3.7 cubic meters per hectare per year) in a 50-year-old, even-aged, fully stocked stand.

The main concerns in producing and harvesting timber are the hazard of erosion, the equipment limitation, seedling mortality, plant competition, the hazard of windthrow on the McGarr soil, and fire damage to the soil.

Minimizing the risk of erosion is essential in areas where timber is harvested. Properly designed road drainage systems that include carefully located culverts help to control erosion. Spoil from excavations is subject to rill and gully erosion and to sloughing. Roads, landings, skid trails, and firebreaks can be protected against erosion by constructing water bars and by seeding areas that have been cut and filled. Buffer strips may be needed in areas adjacent to perennial streams to minimize siltation and maintain stream temperatures.

The slope restricts the use of wheeled and tracked equipment on skid trails. High-lead or other logging systems that fully or partially suspend the logs above the ground cause less damage to the soil than tractor systems and reduce the risk of compaction. The risk of compaction also can be reduced by using suitable harvesting methods, laying out skid trails in advance, and harvesting timber when the soil is dry or frozen. Stones on the surface of the McGarr soil can interfere with felling, yarding, and other activities involving the use of equipment.

Trees are subject to windthrow because of the limited rooting depth in the McGarr soil. Regeneration systems that isolate single trees or groups of trees are not practical because of the hazard of windthrow.

Careful management of reforestation is needed to minimize competition from undesirable plants. If the site is not adequately prepared, plant competition can prevent or delay the reestablishment of volunteer or planted trees. Competing weeds, brush, or trees can be controlled by straying, cutting, girdling, or scarifying. Scarification is severely restricted in the steeper areas because of increased expense and soil displacement.

The seedling mortality rate is increased by compaction of the surface layer. A low available water capacity generally limits seedling survival on the McGarr soil in areas where understory plants are numerous. Shading and mulching of seedlings may be required on the McGarr soil. The trees that are suitable for planting include ponderosa pine and Douglas-fir.

Some decline in forest productivity may result from fire of moderate intensity.

The understory on the Top soil consists mainly of creambush oceanspray, mallow ninebark, Rocky Mountain maple, Saskatoon serviceberry, princes pine, and brackenfern.

The understory on the McGarr soil consists mainly of common snowberry, spirea, elk sedge, pinegrass, Idaho fescue, and strawberry. The potential production of native understory on the McGarr soil in a normal year is about 800 pounds of air-dry forage per year.

This unit can produce adequate forage for big game animals after the tree canopy is opened by logging, fire, or some other disturbance. Dense stands of timber should be left in some areas to provide escape and thermal cover for the big game animals.

The Top soil is in the Mixed Fir-Oceanspray woodland understory site. The McGarr soil is in the Pine-Snowberry-Sedge woodland understory site.

168C—Typic Xerorthents, cobbly, 2 to 12 percent slopes. These soils are in areas of mine tailings left from gold-dredging activities. They are mainly on bottom land or low terraces adjacent to streams in Sumpter Valley, Unity Basin, Blue Canyon, Auburn Area, Burnt River Valley, Salmon Creek, and Marble Creek areas in Baker Valley and in the Clarks Creek area east of Bridgeport. Elevation is 2,000 to 5,000 feet. The average annual precipitation is 9 to 24 inches, the average annual air temperature is 40 to 50 degrees F, and the average frost-free period is 50 to 140 days.

Typically, the mine tailings commonly consist of multicolored extremely cobbly loamy sand piled in mounds or rows about 10 to 20 feet high, but the composition varies considerably. In a few areas the soils have enough silt and clay to support some vegetation.

Included in this unit are small areas of Sumpley, Stovepipe, Webfoot, McEwen, Damore, Silvies, Burntriver, Marack, Goodrich, and Benderly soils and Aridic Haploxerolls. Included areas make up less than 10 percent of the total acreage. The percentage varies from one area to another.

Permeability is very rapid in the Typic Xerorthents. Available water capacity varies. It generally is less than 2 inches. In some areas a water table is at a depth of 6 to 10 feet. Runoff is slow or medium, and the hazard of water erosion is slight.

This unit is used mainly for wildlife habitat (fig. 13). It also is used as a source of gravel and roadfill material.

169C—Ukiah silty clay loam, 2 to 12 percent slopes. This moderately deep, well drained soil is on hills. It formed in colluvium derived from volcanic ash and basalt. Areas are irregular in shape and are 40 to 200 acres in size. The native vegetation is mainly bunchgrasses. Elevation is 2,400 to 4,000 feet. The average annual precipitation is 14 to 20 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 120 days.

Typically, the surface layer is very dark brown silty clay loam about 2 inches thick. The upper 8 inches of the subsoil is very dark grayish brown clay. The lower 18 inches is dark brown clay. The substratum is brown loam about 8 inches thick. The depth to weathered bedrock is 20 to 40 inches.

Included in this unit are small areas of Gwinly and Immig soils. Also included are small areas of Ukiah soils that have stones on the surface and small areas of soils that are similar to the Ukiah soil but are more than 40 inches deep over weathered bedrock. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderately slow to a depth of about 10 inches in the Ukiah soil and very slow below that depth. Available water capacity is 3 to 6 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 mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on this unit is dominated by Idaho fescue and bluebunch wheatgrass.

Idaho fescue and bluebunch wheatgrass are the major forage-producing plants. If the site is in excellent condition, the total annual production is estimated at 1,600 pounds per acre in favorable years and 600 pounds per acre in unfavorable years.

If the condition of the site deteriorates through overgrazing, Idaho fescue loses vigor and decreases in extent. Bluebunch wheatgrass increases in extent. Bluegrasses invade. If deterioration continues, the extent of bluebunch wheatgrass decreases and cheatgrass, soft chess, and other annual plants invade the site.

The Ukiah soil is in the Clayey 14-17pz range site.

169D—Ukiah silty clay loam, 12 to 20 percent slopes. This moderately deep, well drained soil is on hills. Areas are irregular in shape and are 40 to 200 acres in size. It formed in colluvium derived from volcanic tuff and basalt. The native vegetation is mainly bunchgrasses. Elevation is 2,400 to 4,000 feet. The average annual precipitation is 14 to 20 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 120 days.

Typically, the surface layer is very dark brown silty clay loam about 2 inches thick. The upper 8 inches of the subsoil is very dark grayish brown clay. The lower 18 inches is dark brown clay. The substratum is brown loam about 8 inches thick. The depth to weathered bedrock is 20 to 40 inches.

Included in this unit are small areas of Gwinly and

Figure 13.—Wildlife habitat on Typic Xerorthents, cobbly, 2 to 12 percent slopes, in Sumpter Valley.

Immig soils. Also included are small areas of soils that are similar to the Ukiah soil but are more than 40 inches deep over weathered bedrock and small areas of Ukiah soils that have stones on the surface. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderately slow to a depth of about 10 inches in the Ukiah soil and very slow below that depth. Available water capacity is 3 to 6 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. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on this unit is dominated by Idaho fescue and bluebunch wheatgrass.

Idaho fescue and bluebunch wheatgrass are the major forage-producing plants. If the site is in excellent condition, the total annual production is estimated at 1,600 pounds per acre in favorable years and 600 pounds per acre in unfavorable years.

If the condition of the site deteriorates through overgrazing, Idaho fescue loses vigor and decreases in extent. Bluebunch wheatgrass increases in extent. Bluegrasses invade. If deterioration continues, the extent of bluebunch wheatgrass decreases and cheatgrass, soft chess, and other annual plants invade the site.

The Ukiah soil is in the Clayey 14-17pz range site.

170A—Umapine silt loam, 0 to 2 percent slopes. This deep, somewhat poorly drained soil is on low terraces. It formed in mixed alluvium. Areas are irregular in shape and are 20 to 200 acres in size. The native vegetation is mainly salt-tolerant grasses and shrubs. Elevation is 2,000 to 3,500 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 110 to 140 days.

Typically, the surface layer is brownish gray silt loam about 12 inches thick. The subsoil is grayish brown and brown silt loam about 28 inches thick. The substratum to a depth of 60 inches or more is brown silt loam.

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

Permeability is moderate in the Umapine soil. Available water capacity is 10 to 13 inches. The effective rooting depth is limited by a seasonal high water table at a depth of 1 to 2 feet in winter and spring. This soil is subject to rare flooding. Runoff is slow, and the hazard of water erosion is slight.

This unit is used mainly for irrigated hay and pasture. It also provides habitat for many kinds of wildlife.

Hay and pasture.—If this unit is used for hay and pasture, the main limitations are the seasonal high water table and the high amount of salts in the surface layer.

The concentration of salts and alkali in the surface layer limits the production of plants suitable for hay and pasture. Leaching of the salts from the surface layer is limited by the high water table. Salt-tolerant grasses should be selected for planting.

Periodic mowing and clipping help to maintain uniform growth and prevent selective grazing. Proper grazing practices, weed control, and fertilizer are needed to ensure maximum quality of forage.

Conducting fieldwork during wet periods results in deterioration of tilth and destroys soil structure. As a result, it increases the runoff rate. Grazing during wet periods results in compaction of the surface layer. Compaction limits the movement of air in the soil and restricts the growth of roots.

This soil is generally unsuited to the trees and shrubs grown as windbreaks and environmental plantings. Onsite investigation is needed to identify areas where trees and shrubs can be planted if special management is applied.

The Umapine soil is in the Sodic Bottom range site.

171B—Virtue silt loam, 2 to 7 percent slopes. This well drained soil is on fans and terraces. It is moderately deep to a duripan. It formed in lacustrine and alluvial sediments influenced by volcanic ash and loess in the surface layer. Areas are long and rectangular and are 80 to 800 acres in size. The native vegetation is mainly bunchgrasses, forbs, and shrubs. Elevation is 2,700 to 4,000 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 110 to 130 days.

Typically, the surface layer is dark brown silt loam about 7 inches thick. The next layer is dark brown silty clay loam about 8 inches thick. The upper 14 inches of the subsoil is dark yellowish brown silty clay loam and yellowish brown loam. The next layer is a grayish brown, silica-cemented duripan about 13 inches thick. The lower part of the subsoil to a depth of about 60 inches is light yellowish brown very gravelly loam. The depth to a duripan is 20 to 40 inches.

Included in this unit are small areas of Legler and Encina soils. Also included are small areas of soils that are similar to the Virtue soil but are less than 20 inches deep to a duripan. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderately slow above the duripan in the Virtue soil. Available water capacity is 4 to 7 inches. The effective rooting depth is 20 to 40 inches. Runoff is slow, and the hazard of water erosion is slight or moderate.

This unit is used mainly for livestock grazing. In a few areas it is used for irrigated small grain or for hay and pasture. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on this unit is dominated by Idaho fescue, needleandthread, and Wyoming big sagebrush.

Idaho fescue and needleandthread are the major forage-producing plants. If the site is in excellent condition, the total annual production is estimated at 1,500 pounds per acre in favorable years and 500 pounds per acre in unfavorable years.

If the condition of the site deteriorates through overgrazing, Idaho fescue loses vigor and decreases in extent. Needleandthread, Thurber needlegrass, Sandberg bluegrass, and Wyoming big sagebrush increase in extent. If deterioration continues, the extent of needlegrass decreases and cheatgrass and other annual grasses and forbs invade the site.

Hay and pasture or cropland.—If this unit is used for irrigated hay and pasture or small grain the main limitation is the rooting depth. Ripping and shattering the duripan increase the effective rooting depth and improve internal drainage.

In summer irrigation is needed for the production of most crops. Irrigation water can be applied by the sprinkler method. Sprinkler irrigation permits the even, controlled application of water and helps to control runoff. To avoid 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.

Fertilizer is needed to ensure the optimum growth of grasses and legumes. 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.

Management that maintains the optimum vigor and quality of forage plants is needed. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and control erosion. Periodic mowing and clipping help to maintain uniform growth and prevent selective grazing.

Grazing during wet periods results in compaction to the surface layer, poor tilth, and excessive runoff. Compaction limits the movement of air and water in the soil and restricts the growth of roots.

The trees and shrubs grown as windbreaks and environmental plantings should be those that are tolerant of a high content of lime. The free carbonates in the soil tie up minerals and limit their availability. A very low available water capacity may cause severe seedling mortality. Continued cultivation, mulching, or applications of herbicide to control competing vegetation are needed to ensure the establishment and survival of seedlings.

The Virtue soil is in the Mountain Loamy 9-12pz range site.

171C—Virtue silt loam, 7 to 12 percent slopes. This well drained soil is on fans and terraces. It is moderately deep to a duripan. It formed in lacustrine and alluvial sediments influenced by volcanic ash and loess in the surface layer. Areas are long and rectangular and are 80 to 800 acres in size. The native vegetation is mainly bunchgrasses, forbs, and shrubs. Elevation is 2,700 to 4,000 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 110 to 130 days.

Typically, the surface layer is dark brown silt loam about 7 inches thick. The next layer is dark brown silty clay loam about 8 inches thick. The upper 14 inches of the subsoil is dark yellowish brown silty clay loam and yellowish brown loam. The next layer is a grayish brown, silica-cemented duripan about 13 inches thick. The lower part of the subsoil to a depth of about 60 inches is light yellowish brown very gravelly loam. The depth to a duripan is 20 to 40 inches.

Included in this unit are small areas of North Powder, Ruckles, and Ruclick soils. Also included are small areas of Legler soils and small areas of soils that are similar to the Virtue soil but are less than 20 inches deep to a duripan. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderately slow above the duripan in the Virtue soil. Available water capacity is 4 to 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 mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on this unit is dominated by Idaho fescue, needleandthread, and Wyoming big sagebrush.

Idaho fescue and needleandthread are the major forage-producing plants. If the site is in excellent condition, the total annual production is estimated at 1,500 pounds per acre in favorable years and 500 pounds per acre in unfavorable years.

If the condition of the site deteriorates through overgrazing, Idaho fescue loses vigor and decreases in extent. Needleandthread, Thurber needlegrass, Sandberg bluegrass, and Wyoming big sagebrush increase in extent. If deterioration continues, the extent of needlegrass decreases and cheatgrass and other annual grasses and forbs invade the site.

The Virtue soil is in the Mountain Loamy 9-12pz range site.

172B—Virtue very gravelly silt loam, 2 to 7 percent slopes. This well drained soil is on fans and terraces. It is moderately deep to a duripan. It formed in lacustrine and alluvial sediments influenced by loess and volcanic ash in the surface layer. Areas are long and rectangular and are 80 to 800 acres in size. The native vegetation is mainly bunchgrasses, forbs, and shrubs. Elevation is 2,700 to 4,000 feet. The average annual precipitation is 9 to 14 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 110 to 130 days.

Typically, the surface layer is dark brown very gravelly silt loam about 7 inches thick. The next layer is dark brown silty clay loam about 8 inches thick. The upper 14 inches of the subsoil is dark yellowish brown silty clay loam and yellowish brown loam. The next layer is a silica-cemented duripan about 13 inches thick. The lower part of the subsoil to a depth of about 60 inches is light yellowish brown very gravelly loam. The depth to a duripan is 20 to 40 inches.

Included in this unit are small areas of Legler and Encina soils. Also included are small areas of soils that are similar to the Virtue soil but are less than 20 inches deep to a duripan. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderately slow above the duripan in the Virtue soil. Available water capacity is 4 to 7 inches.

The effective rooting depth is 20 to 40 inches. Runoff is slow, and the hazard of water erosion is slight or moderate.

This unit is used mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on this unit is dominated by Idaho fescue, needleandthread, and Wyoming big sagebrush.

Idaho fescue and needleandthread are the major forage-producing plants. If the site is in excellent condition, the total annual production is estimated at 1,500 pounds per acre in favorable years and 500 pounds per acre in unfavorable years.

If the condition of the site deteriorates through overgrazing, Idaho fescue loses vigor and decreases in extent. Needleandthread, Thurber needlegrass, Sandberg bluegrass, and Wyoming big sagebrush increase in extent. If deterioration continues, the extent of needlegrass decreases and cheatgrass and other annual grasses and forbs invade the site.

The Virtue soil is in the Mountain Loamy 9-12pz range site.

172C—Virtue very gravelly silt loam, 7 to 12 percent slopes. This well drained soil is on fans and terraces. It is moderately deep to a duripan. It formed in lacustrine and alluvial sediments influenced by loess and volcanic ash in the surface layer. Areas are long and rectangular and are 80 to 800 acres in size. The native vegetation is mainly bunchgrasses, forbs, and shrubs. Elevation is 2,700 to 4,000 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 110 to 130 days.

Typically, the surface layer is dark brown very gravelly silt loam about 7 inches thick. The next layer is dark brown silty clay loam about 8 inches thick. The upper 14 inches of the subsoil is dark yellowish brown silty clay loam and yellowish brown loam. The next layer is a silica-cemented duripan about 13 inches thick. The lower part of the subsoil to a depth of about 60 inches is light yellowish brown very gravelly loam. The depth to a duripan is 20 to 40 inches.

Included in this unit are small areas of Legler and Encina soils. Also included are small areas of soils that are similar to the Virtue soil but are less than 20 inches deep to a duripan. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderately slow above the duripan in the Virtue soil. Available water capacity is 4 to 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 mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on this unit is dominated by Idaho fescue, needleandthread, and Wyoming big sagebrush.

Idaho fescue and needleandthread are the major forage-producing plants. If the site is in excellent condition, the total annual production is estimated at 1,500 pounds per acre in favorable years and 500 pounds per acre in unfavorable years.

If the condition of the site deteriorates through overgrazing, Idaho fescue loses vigor and decreases in extent. Needleandthread, Thurber needlegrass, Sandberg bluegrass, and Wyoming big sagebrush increase in extent. If deterioration continues, the extent of needlegrass decreases and cheatgrass and other annual grasses and forbs invade the site.

The Virtue soil is in the Mountain Loamy 9-12pz range site.

173C—Wahstal very cobbly loam, 2 to 12 percent slopes. This well drained soil is on the tops of old terraces and on adjacent fans. It is shallow to a duripan. It formed in mixed alluvium. Areas are irregular in shape and are 40 to 100 acres in size. The native vegetation is mainly bunchgrasses, shrubs, and forbs. Elevation is 4,700 to 5,200 feet. The average annual precipitation is 12 to 16 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 60 to 90 days.

Typically, the surface layer is very dark grayish brown very cobbly loam about 4 inches thick. The next layer is dark brown very cobbly clay loam about 8 inches thick. The upper 6 inches of the subsoil is dark yellowish brown extremely cobbly clay. The lower 5 inches is a duripan. The substratum to a depth of 60 inches or more is extremely cobbly sandy loam. The depth to a duripan is 10 to 20 inches.

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

Permeability is slow above the duripan in the Wahstal soil. Available water capacity is 1 to 2 inches. The effective rooting depth is 10 to 20 inches. Runoff is slow or medium, and the hazard of water erosion is slight or moderate.

This unit is used mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on this unit is dominated by onespike oatgrass, stiff sagebrush, and Sandberg bluegrass.

Onespike oatgrass and Sandberg bluegrass are the major forage-producing plants. If the site is in excellent condition, the total annual production is estimated at

600 pounds per acre in favorable years and 200 pounds per acre in unfavorable years. Livestock access is limited by the very cobbly surface layer.

If the condition of the site deteriorates through overgrazing, onespike oatgrass loses vigor and decreases in extent. Sandberg bluegrass, lomatium, and stiff sagebrush increase in extent. If deterioration continues, the extent of Sandberg bluegrass decreases and annuals invade the site.

Range seeding is not practical because of the cobbles on the surface. Brush control is not advisable because of the value of stiff sagebrush for wildlife and livestock forage.

The Wahstal soil is in the Mountain Very Shallow 12-16pz range site.

174B—Webfoot silt loam, 0 to 7 percent slopes. This deep, somewhat poorly drained soil is on low terraces. It formed in mixed alluvium influenced by loess and volcanic ash in the surface layer. Areas are irregular in shape and are 20 to 80 acres in size. The native vegetation is mainly conifers, shrubs, bunchgrasses, and forbs. Elevation is 3,800 to 4,200 feet. The average annual precipitation is 16 to 24 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 50 to 90 days.

Typically, the surface layer is very dark brown silt loam about 6 inches thick. The next layer is very dark grayish brown gravelly loam about 7 inches thick. The subsoil is very dark grayish brown gravelly sandy loam about 8 inches thick. The substratum to a depth of 60 inches or more is dark gray and olive gray very gravelly or extremely gravelly sandy loam to sand. Depth to the gravelly substratum is 20 to 40 inches.

Included in this unit are small areas of Sumpley, Stovepipe, and McEwen soils. Also included are small areas of soils that are similar to the Webfoot soil but are moderately well drained. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate to a depth of about 6 inches in the Webfoot soil, moderately rapid between depths of about 6 and 25 inches, and rapid below 25 inches. Available water capacity is 4 to 6 inches. The effective rooting depth is limited by a seasonal high water table at a depth of 1 to 2 feet in spring and early summer. This soil is subject to rare flooding. Runoff is slow, and the hazard of water erosion is slight or moderate.

This unit is used mainly for timber production. It also is used for livestock grazing, and it provides habitat for many kinds of wildlife.

Woodland.—This unit is suited to the production of ponderosa pine. The mean site index is 96 for ponderosa pine (100-year base age). The potential production at culmination of the mean annual increment for ponderosa pine is 96 cubic feet per acre per year (6.7 cubic meters per hectare per year) in a 40-year-old, even-aged, fully stocked stand.

The main concerns in producing and harvesting timber on this unit are equipment limitations, plant competition, seedling mortality, and the hazard of windthrow.

Using standard wheeled and tracked equipment when the soil is moist causes rutting and compaction. The risk of compaction can be reduced by using low-pressure ground equipment, laying out skid trails in advance, and harvesting timber when the soil is dry or frozen.

Careful management of reforestation is needed to minimize competition from undesirable plants. If the site is not adequately prepared, plant competition can prevent or delay the reestablishment of volunteer or planted trees. Competing weeds, brush, or trees can be controlled by spraying, cutting, girdling, or scarifying.

The seedling mortality rate is increased by compaction of the surface layer and because of restricted drainage. The trees that are suitable for planting include ponderosa pine.

Because root growth is restricted by the seasonal high water table, trees are subject to windthrow during periods when the soil is excessively wet and winds are strong. Regeneration systems that isolate single trees or groups of trees are not practical because of the hazard of windthrow.

Grazable woodland.—This unit is suitable for use as grazable woodland. The understory consists mainly of willows, common snowberry, spirea, elk sedge, and wild strawberry.

A system that results in proper grazing use is essential if livestock graze this unit. Timely deferment of grazing is needed to allow the desirable plants to mature and set seed. Grazing should be delayed in spring until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.

Grazing during wet periods results in compaction of the surface layer. Compaction limits the movement of air and water in the soil and restricts the growth of roots.

Seeding disturbed areas to suitable plants increases forage production. Deferred grazing or exclusion is necessary for the establishment of tree seedlings.

The Webfoot soil is in the Pine-Willow-Sedge woodland understory site.

175A—Wingdale silt loam, 0 to 2 percent slopes. This deep, poorly drained soil is on flood plains. It formed in mixed alluvium influenced by volcanic ash in the surface layer. Areas are irregular in shape and are 20 to 200 acres in size. The native vegetation is mainly water-tolerant grasses and sedges. Elevation is 2,200 to 3,400 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 45 to 50 degrees F, and the frost-free period is 110 to 140 days.

Typically, the surface layer is black and very dark gray silt loam about 23 inches thick. The next layer is very dark grayish brown, mottled silt loam. It extends to a depth of about 34 inches. The substratum to a depth of 60 inches or more is dark grayish brown and dark gray silty clay loam and gravelly silty clay loam.

Included in this unit are small areas of Wingville and Baldock soils. Also included are small areas of Balm and Haines soils. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderately slow in the Wingdale soil. Available water capacity is 10 to 12 inches. The effective rooting depth is limited by a seasonal high water table within a depth of 1.5 feet in spring. This soil is occasionally flooded for brief periods in spring. Runoff is slow, and the hazard of water erosion is slight.

This unit is used mainly for irrigated hay and pasture. It also provides habitat for many kinds of wildlife.

Hay and pasture.—If this unit is used for hay and pasture, the main limitation is the seasonal high water table. Wetness limits the choice of plants and the period of cutting or grazing and increases the risk of winterkill. Grazing during wet periods results in compaction of the surface layer, poor tilth, and excessive runoff. Conducting fieldwork during wet periods results in deterioration of tilth and destroys soil structure. As a result, it increases the runoff rate and the hazard of erosion. Compaction limits the movement of air and water in the soil and restricts the growth of roots.

Fertilizer is needed to ensure the optimum growth of grasses and legumes.

In summer irrigation is needed for the maximum production of most hay crops. Controlled surface irrigation is a suitable method of applying water. Leveling helps to ensure the uniform application of water. To avoid 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.

Management that maintains the optimum vigor and quality of forage plants is needed. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and control erosion. Periodic mowing and clipping help to maintain uniform growth and prevent selective grazing.

Because of salt concentrations, the selection of trees and shrubs that can be grown as windbreaks and environmental plantings is limited and seedling mortality is severe. The species selected for planting should be those that can withstand excess moisture. Spring planting may be delayed because of the excess moisture.

The Wingdale soil is in the Wet Meadow range site.

176A—Wingville silt loam, 0 to 2 percent slopes. This deep, somewhat poorly drained soil is on alluvial fans and broad alluvial terraces. It formed in mixed alluvium influenced by volcanic ash in the surface layer. Areas are irregular in shape and are 20 to 200 acres in size. The native vegetation is mainly grasses and sedges. Elevation is 2,200 to 3,600 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 45 to 50 degrees F, and the average annual frost-free period is 110 to 140 days.

Typically, the surface layer is black and very dark gray silt loam about 23 inches thick. The next layer is very dark grayish brown, mottled silt loam about 10 inches thick. The upper part of the substratum is light brownish gray and olive gray silt loam and silty clay loam. It extends to a depth of about 53 inches. The lower part to a depth of 60 inches or more is gravelly silt loam.

Included in this unit are small areas of Goodrich and Baker soils. Also included are small areas of Baldock and Wingdale soils. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate to a depth of about 8 inches in the Wingville soil and moderately slow below that depth. Available water capacity is 11 to 13 inches. The effective rooting depth is limited by a seasonal high water table at a depth of 1.5 to 3.0 feet in spring. This soil is subject to rare flooding. Runoff is slow, and the hazard of water erosion is slight.

This unit is used mainly for irrigated hay and pasture. It also provides habitat for many kinds of wildlife.

Hay and pasture.—If this unit is used for hay and pasture, the main limitation is the high water table. Wetness limits the choice of plants and the period of cutting or grazing and increases the risk of winterkill.

Grazing during wet periods results in compaction of the surface layer, poor tilth, and excessive runoff. Conducting fieldwork during wet periods results in deterioration of tilth and destroys soil structure. Compaction limits the movement of air and water in the soil and restricts the growth of roots.

Fertilizer is needed to ensure the optimum growth of grasses and legumes.

In summer irrigation is needed for the maximum production of most hay crops. Controlled surface irrigation is a suitable method of applying water. Leveling helps to ensure the uniform application of water. To avoid 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.

Management that maintains the optimum vigor and quality of forage plants is needed. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and control erosion. Periodic mowing and clipping help to maintain uniform growth and prevent selective grazing.

Because of salt concentrations, the selection of trees and shrubs that can be grown as windbreaks and environmental plantings is limited and seedling mortality is severe. The species selected for planting should be those that can withstand excess moisture. Spring planting may be delayed because of the excess moisture.

The Wingville soil is in the Meadow range site.

177E—Xeric Torriorthents, 35 to 60 percent south slopes. These very shallow or shallow, well drained soils are on terrace escarpments. They formed in colluvium and residuum derived from silty lacustrine sediments. Areas are irregular in shape and are 10 to 200 acres in size. The native vegetation is mainly bunchgrasses, forbs, and shrubs. Elevation is 2,200 to 3,600 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 110 to 140 days.

Typically, the surface layer is grayish brown silt loam about 3 inches thick. The subsoil is grayish brown silt loam about 4 inches thick. Lacustrine sediments are at a depth of 7 inches. The depth to lacustrine sediments ranges from 3 to 20 inches.

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

Permeability is moderate in the Xeric Torriorthents. Available water capacity is 0.5 inch to 2.0 inches. The effective rooting depth is 3 to 20 inches. Runoff is rapid, and the hazard of water erosion is high or very high.

This unit is used mainly for wildlife habitat. It is not suitable for livestock grazing because of fragile, steep, and unstable slopes.

Livestock grazing.—The potential plant community on this unit is dominated by antelope bitterbrush, needieandthread, and basin big sagebrush.

Antelope bitterbrush and needleandthread are the major forage-producing plants for wildlife. If the site is in excellent condition, the total annual production is estimated at 1,000 pounds per acre in favorable years and 500 pounds per acre in unfavorable years. Usable production suitable for wildlife is limited by the slope and instability of the soil.

If the condition of the site deteriorates through overgrazing, antelope bitterbrush, needleandthread, Thurber needlegrass, and basin wildrye lose vigor and decrease in extent. Basin big sagebrush and rabbitbrush increase slightly. Cheatgrass and other annual grasses and forbs sparsely invade the site.

Range seeding is not practical because of the slope. Brush control is not advisable because of the value of antelope bitterbrush for wildlife food and cover.

The Xeric Torriorthents are in the Terrace Escarpment 9-12pz range site.

178F—Xeric Torriorthents-Rock outcrop complex, 50 to 80 percent slopes. This map unit is on canyon side slopes. Areas are irregular in shape and are 100 to 400 acres in size. The native vegetation is mainly bunchgrasses, shrubs, and mountainmahogany. Elevation is 2,000 to 4,000 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 140 days.

This unit is about 60 percent Xeric Torriorthents 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 selected scale.

Included in this unit are small areas of Ruclick and Ruckles soils. Included areas make up about 10 percent of the total area. The percentage varies from one area to another.

The Xeric Torriorthents are shallow to deep and are excessively drained. They formed in colluvium derived from basalt, andesite, argillite, and gabbro. Typically, the surface layer is grayish brown extremely stony loam about 11 inches thick. The subsoil is light yellowish brown extremely stony loam about 13 inches thick. The depth to hard bedrock is mainly 10 to 60 inches.

Permeability is rapid in the Xeric Torriorthents. Available water capacity is 0.5 inch to 2.0 inches. The effective rooting depth is mainly 10 to 60 inches. Runoff is rapid, and the hazard of water erosion is high or very high.

This unit is used mainly for livestock grazing. It also provides habitat for many kinds of wildlife.

Livestock grazing.—The potential plant community on the Xeric Torriorthents is dominated by curlleaf mountainmahogany, bluebunch wheatgrass, antelope bitterbrush, and Nevada greasebush.

Bluebunch wheatgrass is the major forage-producing plant. If the site is in excellent condition, the total annual production is estimated at 900 pounds per acre in favorable years and 300 pounds per acre in unfavorable years. Livestock access is limited by the slope, the Rock outcrop, and the stones on the surface.

If the condition of the site deteriorates through overgrazing, bluebunch wheatgrass, curlleaf mountainmahogany, and antelope bitterbrush lose vigor and decrease in extent. Cheatgrass and other annual plants invade the site.

Range seeding is not practical because of the slope and the stoniness of the surface. Brush control is not advisable because of the value of curlleaf mountainmahogany and bitterbrush for wildlife.

The Xeric Torriorthents are in the Mahogany Rockland 9-12pz range site.

Prime Farmland

In this section, prime farmland is defined and discussed and the prime farmland soils in this survey area are listed.

Prime farmland is of major importance in providing the nation's short- and long-range needs for food and fiber. The acreage of high-quality farmland is limited, and the U.S. Department of Agriculture recognizes that government at local, state, and federal levels, as well as individuals, must encourage and facilitate the wise use of our nation's prime farmland.

Prime farmland soils, as defined by the U.S. Department of Agriculture, are soils that are best suited to producing food, seed, forage, fiber, and oilseed crops. Such soils have properties that are favorable for the economic production of sustained high yields of crops. The soils need only to be treated and managed using acceptable farming methods. Adequate moisture and a sufficiently long growing season are required. Prime farmland soils produce the highest yields with minimal inputs of energy and economic resources, and farming these soils results in the least damage to the environment.

Prime farmland soils may be in use as cropland or pasture, or they may be in other uses. They either are used for producing food and fiber or are available for these uses. Urban or built-up land, public land, and water areas cannot be considered prime farmland.

Prime farmland soils commonly get an adequate and dependable supply of moisture from precipitation or irrigation. Temperature and length of growing season are favorable, and level of acidity or alkalinity is acceptable. The soils have few, if any, rocks and are permeable to water and air. They are not excessively erodible or saturated with water for long periods and are not flooded during the growing season. The slope ranges mainly from 0 to 7 percent.

Soils that have a high water table, are subject to flooding, or are droughty may qualify as prime farmland soils if the limitations are overcome by drainage, flood control, or irrigation. Onsite evaluation is necessary to determine the effectiveness of corrective measures. More information on the criteria for prime farmland soils can be obtained at the local office of the Natural Resources Conservation Service.

A recent trend in land use has been the conversion of prime farmland to urban and industrial uses. The loss of prime farmland to other uses puts pressure on lands that are less productive than prime farmland.

About 130,000 acres, or nearly 10 percent of the survey area, would meet the requirements for prime farmland if an adequate and dependable supply of irrigation water were available.

The following map units meet the soil requirements for prime farmland when irrigated. On some soils included in the list, measures should be used to overcome a hazard or limitation, such as flooding, wetness, or droughtiness. The location of each map unit is shown on the detailed soil maps at the back of this publication. Soil qualities that affect use and management are described in the section "Detailed Soil Map Units." This list does not constitute a recommendation for a particular land use.

4B	Applegate silt loam, 2 to 7 percent slopes (where irrigated)
11A	Baker silt loam, 0 to 2 percent slopes (where irrigated)
11B	Baker silt loam, 2 to 7 percent slopes (where irrigated)
12A	Baker silt loam, 0 to 2 percent slopes, warm (where irrigated)
12B	Baker silt loam, 2 to 7 percent slopes, warm (where irrigated)
13A	Baldock silt loam, 0 to 2 percent slopes (where irrigated and drained)
15A	Balm loam, 0 to 3 percent slopes (where irrigated and drained)
16B	Barnard silt loam, 2 to 7 percent slopes (where irrigated)
23A	Boyce silt loam, 0 to 2 percent slopes (where irrigated and drained)
32A	Burntriver silt loam, 0 to 2 percent slopes (where irrigated)
35A	Catherine silt loam, 0 to 2 percent slopes (where irrigated)
40A	Cumulic Haploxerolls, 0 to 2 percent slopes (where irrigated)

53B Glasgow silt loam, 2 to 7 percent slopes (where irrigated)

54B Goodrich gravelly loam, 0 to 7 percent slopes (where irrigated)

71B Hibbard silt loam, 2 to 7 percent slopes (where irrigated)

84D Jett silt loam, 0 to 3 percent slopes (where irrigated)

90B Ladd loam, 2 to 7 percent slopes (where irrigated)

91A La Grande silt loam, 0 to 3 percent slopes (where irrigated)

92A Langrell gravelly loam, 0 to 3 percent slopes (where irrigated)

126A Powval silt loam, 0 to 3 percent slopes (where irrigated)

127A Powval silt loam, 0 to 3 percent slopes, warm (where irrigated)

128B Pritchard silty clay loam, 2 to 7 percent slopes (where irrigated)

171B Virtue silt loam, 2 to 7 percent slopes (where irrigated)

175A Wingdale silt loam, 0 to 2 percent slopes (where irrigated and drained)

176A Wingville silt loam, 0 to 2 percent slopes (where irrigated)

Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavioral characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as rangeland and woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

Crops and Pasture

By Rhoda K. Portis, district conservationist, Natural Resources Conservation Service.

General management needed for crops and for hay and pasture is suggested in this section. The system of land capability classification used by the Natural Resources Conservation Service is explained, and the estimated yields of the main crops and hay and pasture plants commonly grown are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed Soil Map Units." Specific information can be obtained from the local office of the Natural Resources Conservation Service or the Cooperative Extension Service.

Nearly all of the farming in the survey area is on the terraces and flood plains of the five major valleys. A few small areas in the uplands, such as the Sparta area, are dryland farmed.

About 154,000 acres in Baker County is used for crops and pasture. Of this total, 129,000 acres is used for irrigated crops and 25,000 acres for nonirrigated crops. About 63,000 acres of the total cropland is used for pasture, 67,500 acres for hayland, 11,000 acres for wheat, 10,500 acres for barley, 1,000 acres for oats, 600 acres for field corn, 300 acres for potatoes, and 100 acres for orchards.

Irrigated cropland is used mainly for hay, pasture, wheat, oats, barley, corn, and potatoes. Irrigation methods vary throughout the county. There are 2,500 acres irrigated by center pivots, 16,000 acres by hand-move systems, 48,000 acres by side roll, 62,000 acres by gravity flood systems, and 500 acres by big guns.

Irrigation water is delivered to farms primarily from a system of canals, ditches, and reservoirs, all of which are supplied by snowmelt originating in the Blue and Wallowa Mountains.

The annual production of irrigated alfalfa hay under full season irrigation is 4 to 7 tons per acre. Stands are in a 6-to-8-year rotation with 2 years of grain. Sulfur and phosphorus commonly are applied in accordance with soil test recommendations. Soil erosion from winter runoff is usually within acceptable limits because of adequate plant cover. Irrigation water management practices are needed to minimize irrigation erosion. Converting from surface irrigation systems to sprinkler and gated pipe systems reduces irrigation-induced erosion.

The annual production of irrigated grass hay is 3 to 6 tons per acre. Nitrogen is applied in the spring. Converting to sprinkler irrigation systems on slopes of more than 7 percent helps to reduce irrigation erosion and conserve water. Soil erosion from winter runoff is usually within acceptable limits in areas with steeper slopes if adequate plant cover is maintained.

The annual production of irrigated wheat averages 60 to 100 bushels per acre for winter wheat and 45 to 55 bushels per acre for spring wheat. Winter wheat is planted from September 1 to November 1. Nitrogen, sulfur, and phosphorus are applied according to needs as indicated by soil tests or field trials before planting. An additional application of nitrogen may be applied to winter wheat in spring. Weeds are controlled by tillage and herbicides. Soil erosion from winter runoff can be reduced by the use of crop residue management, minimum tillage, and cross-slope farming. Converting from surface irrigation systems to sprinkler systems will reduce irrigation-induced erosion.

The annual production of irrigated barley averages 70 bushels per acre. Nitrogen, sulfur, and phosphorus are applied where soil tests indicate a need. Weed- and erosion-control measures are similar to those used for wheat. Barley is often planted on soils that are moderately affected by salts or that are moderately alkaline or strongly alkaline.

Irrigated field corn is raised in the Richland and Huntington areas. Only about 100 to 200 acres is harvested for grain yielding about 100 bushels per acre. The remaining 400 to 500 acres is cut for silage yielding 25 to 35 tons per acre.

Irrigated potatoes are grown in Baker Valley. The average annual yield is 350 hundredweight per acre on approximately 300 acres.

Areas of nonirrigated cropland are used mainly for wheat, hay, and pasture in rotation. The annual yield of dryland wheat ranges from 25 to 75 bushels per acre. Wheat is usually planted from September 1 to November 1. Nitrogen and sulfur are usually applied before planting, and an additional application of nitrogen is made in the spring. Phosphorus is applied where soil tests or field trials indicate a need. Weeds are controlled by tillage or herbicides. Runoff can cause severe erosion on frozen wheat fallow areas where the slopes exceed 7 percent. Sheet and rill erosion is most common, but gully erosion may be a problem in some fields. Most erosion occurs in the spring from snowmelt runoff and spring storms. Crop residue management, minimum tillage, and cross-slope farming can help to control erosion.

Yields per Acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 5. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green-manure crops; and harvesting that ensures the smallest possible loss.

For yields of irrigated crops, it is assumed that the irrigation system is adapted to the soils and to the crops grown, that good quality irrigation water is uniformly applied as needed, and that tillage is kept to a minimum.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 5 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Natural Resources Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops (*25*). Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor does it consider possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for woodland, and for engineering purposes.

In the capability system, soils generally are grouped at three levels: capability class, subclass, and unit. Only class and subclass are used in this survey. These levels are defined in the following paragraphs.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation.

Capability units are soil groups within a subclass. The soils in a capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity. Capability units generally are designated by adding an Arabic numeral to the subclass symbol, for example, IIe-4 or IIIe-6.

The capability classification of each map unit on the detailed soil map is given in table 5.

Rangeland

By Alan Bahn, area range conservationist, Natural Resources Conservation Service.

Rangeland makes up about 70 percent of the survey area and occurs from the depths of the Snake River Canyon in the eastern part of the survey area to the higher elevations in the Elkhorn Mountains and upper Burnt River drainage on the western edge of the survey area.

Two Major Land Resource Areas (*28*) are represented in the survey area. The Upper Snake River Lava Plains and Hills (MLRA B10) make up the majority of the area. A southern extension of the Palouse and Nez Perce Prairies (MLRA B9) is in the northeast corner of the survey area adjacent to the Pine Creek drainage system (general soil map units 4 and 15).

The Upper Snake River Lava Plains and Hills Resource Area is a shrub grassland steppe primarily on clayey soils. It is represented within the survey area by a series of lower elevation range sites on mesic soils and a series of higher elevation range sites on frigid and near frigid soils. The lower elevation range sites are along the Snake River and lower elevations of the Powder River and Burnt River drainages in a 9-to-12-inch precipitation zone. The higher elevation sites are in the mid-to-upper elevations of the Powder River and Burnt River drainages from Virtue Flat, Sparta, and Lookout Mountain to the Bridgeport and Unity areas. These higher elevation range sites are categorized into a 9-to-12-inch precipitation zone, a 12-to-16-inch precipitation zone, and a 16-to-20-inch precipitation zone.

Studies of relic areas and range sites in excellent condition show that the lower elevation sites in Snake River Lava Plains and Hills Resource Area (MLRA B10) were once dominated by bluebunch wheatgrass on ridgetops, hilltops, and south-facing slopes and Idaho fescue on the north-facing slopes. Depending on landscape position, types of soils, and parent material, varying amounts of Wyoming big sagebrush and basin big sagebrush grew on those sites. A variety of materials ranging from Mesozoic basalts, gabbros, argillites, and schists to more recent Cenozoic basalts and sediments underlie the soils in this area. Because of the variety of soils and parent materials, many unique soil-plant relationships are in this area, such as the Snake River greasebush on slaty south slopes and antelope bitterbrush and needlegrasses on terrace escarpments.

The range sites in the mid-to-higher elevations in MLRA B10 resource area are in the same geological setting, with the additions of granite and limestone. There are, however, some major differences. In the 9-to-12-inch precipitation zone, as on Virtue Flat, Idaho fescue and Wyoming big sagebrush are the original dominant plant species on nearly level soils having a clayey subsoil, whereas needlegrasses and Wyoming big sagebrush are on loamy and gravelly soils. Bluebunch wheatgrass is dominant on south aspects. There is a good understory of Sandberg bluegrass and some squaw apple on rock outcrops and on fractured or porous soil areas. As the precipitation increases to 12 inches, there is a marked increase in basin big sagebrush and a definite transition to mountain big sagebrush.

In the 12-to-16-inch precipitation zone, mountain big sagebrush and Idaho fescue are the dominant plants on nearly level soils with a clayey subsoil. Also included are lesser amounts of basin big sagebrush and highly variable amounts of bitterbrush and squaw apple, depending on soil depth and texture, landscape position, and range condition. Bluebunch wheatgrass is the dominant plant only on south aspects. Mountain big sagebrush, which is dependent on colder temperatures and a long snowpack period, can increase rapidly as the condition of the range deteriorates. It will occur even on south aspects, becoming more common at higher elevations.

Rangeland in the higher elevation, 16-to-20-inch precipitation zone is in the forest and on higher mountain south-facing slopes. The range sites occur in two distinct soil-aspect related groups. The first group consists of sites over granitics and rhyolite typically on coarse loamy soils on south-facing slopes. They have a strong component of buckwheat, blue wildrye, and needlegrass in addition to bluebunch wheatgrass, minor bitterbrush, and squaw apple. The second group, those over argillite, are on clayeye soils on south-facing slopes. These sites show stronger representation of mountain big sagebrush, squaw apple, bitter cherry, and bitterbrush in addition to the dominant bluebunch wheatgrass. Very shallow soils are in this zone and support a plant community dominated by stiff sagebrush and Sandberg bluegrass. These very shallow range sites also are in the 9-to-12-inch and 12-to-16-inch precipitation zones.

Within all three precipitation zones, plant production and composition change as the soil depth decreases from moderately deep to very shallow.

The Palouse and Nez Perce Prairies Major Land Resource Area in the northeast corner of the survey is a grassland steppe. Its location within the survey area is interesting from many standpoints. The rainshadow effect immediately east of the Wallowa Mountains dictates the kinds and amounts of range vegetation. The area has a rugged upland aspect of deep canyons, high rims, and a series of rimrocks shaped from basalts of various ages. Soils with a clayey subsoil are dominant. The precipitation tapers off rapidly within the Snake River Canyon as one proceeds south to Brownlee Dam. A similar change also occurs in the ranges southeast of Halfway near the Powder River.

The production of the grassland sites on moderately deep to deep soils in this area is much greater than in the Upper Snake River Lava Plains and Hills Resource Area because of the higher precipitation at the lower elevations and the lack of a sagebrush component. The soil depth on the nearly level plateaus or structural benches within the area are for the most part limiting. Consequently, sites on north slopes having deep soils in a 14-to-18-inch precipitation zone are the most productive.

Dominated by Idaho fescue and lesser amounts of bluebunch wheatgrass, deep north-slope sites have a shrub component that includes chokecherry, hawthorn, snowberry, serviceberry, elderberry, and mockorange. Shrubs occur in random patches. Moderately deep soils have sites that are dominated by grasses.

South-slope sites in original condition are dominated by extensive stands of bluebunch wheatgrass and minor amounts of Idaho fescue and a highly variable bitterbrush component. The plateaus or structural benches in good condition are dominated by Idaho fescue and bluebunch wheatgrass. Production changes rapidly with soil depth, but the amount of Sandberg bluegrass increases dramatically on very shallow soils.

Rangeland condition throughout the survey area varies considerably. Many areas show an improvement in desirable species and total production. Native species preferred by grazing animals, such as Idaho fescue and bluebunch wheatgrass, have reasonable resilience. In areas where those species have not been eliminated and remnants remain, marked improvement can and has been achieved with good management. Supplemental improvement practices such as brush control, where applicable, can augment good management and accelerate improvement.

On other areas where the better bunchgrass species have been eliminated, low-producing and short-season plants, such as cheatgrass and medusahead, have invaded. Erosion hazards have increased. Sheet, rill, and gully erosion can drastically decrease the productivity of sites. Many of the nearly level soils in poor condition have been reseeded to improved and long-lasting desirable forage species.

Range Sites and Condition Classes

A range site is a distinctive kind of rangeland that produces a characteristic volunteer plant community that differs from volunteer plant communities on other range sites in kind, amount, and proportion of range plants. A range site is the product of a group of environmental factors—soils, climate, position on the landscape, and vegetation. In areas that have similar climate and topography, differences in the kind and amount of vegetation can be related to soil characteristics. The relationship between soils and vegetation was established during this survey. Each description of the map units on the detailed soil map contains a brief description of the range in the unit, if any, and the response of that range to management.

Table 6 shows, for each soil, the range site; the total annual production of vegetation in favorable, normal, and unfavorable years; the characteristic vegetation; and the average percentage of each species. Only those soils that are used as rangeland or are suited to use as rangeland are listed. Explanation of the column headings in table 6 follows.

A *range site* is a distinctive kind of rangeland that produces a characteristic natural plant community that differs from natural plant communities on other range sites in kind, amount, and proportion of range plants. The relationship between soils and vegetation was established during this survey; thus, range sites generally can be determined directly from the soil map. Soil properties that affect moisture supply and plant nutrients have the greatest influence on the productivity of range plants. Soil reaction, salt content, and a seasonal water table are also important.

Total production is the amount of vegetation that can be expected to grow annually on well managed rangeland that is supporting the potential natural plant community. It includes all vegetation, whether or not it is palatable to grazing animals. It includes the current year's growth of leaves, twigs, and fruit of woody plants. It does not include the increase in stem diameter of trees and shrubs. It is expressed in pounds per acre of air-dry vegetation for favorable, normal, and unfavorable years. In a favorable year, the amount and distribution of precipitation and the temperatures make growing conditions substantially better than average. In a normal year, growing conditions are about average. In an unfavorable year, growing conditions are well below average, generally because of low available soil moisture.

Dry weight is the total annual yield per acre of air-dry vegetation. Yields are adjusted to a common percent of air-dry moisture content. The relationship of green weight to air-dry weight varies according to such factors as exposure, amount of shade, recent rains, and unseasonable dry periods.

Characteristic vegetation. The grasses, forbs, and shrubs that make up most of the potential natural plant community on each soil is listed by common name. Under *composition*, the expected percentage of the total annual production is given for each species making up the characteristic vegetation. The amount that can be used as forage depends on the kinds of grazing animals and on the grazing season.

Composition is the percentage of each species that makes up the total annual production of the potential characteristic vegetation. The amount of production that can be used as forage depends on the kinds of grazing animals and on the grazing season.

Woodland Management and Productivity

By Russell R. Hatz, forester, Natural Resources Conservation Service.

Baker County is one of the primary producers of timber in northeastern Oregon. The best timber growing sites are generally on soils derived from volcanic ash and at mid-elevations in the forested zone. The higher elevations are generally too cold and the lower elevations too dry to produce large quantities of timber. About 17 percent of the survey area is classified as commercial forest land. About 13 percent of the commercial forest land is owned by the forest industry, 66 percent is owned by ranchers and other private parties, and 21 percent is publicly owned.

Baker City is the center of the forest products industry in Baker County. Access to rail transportation facilitates the export of finished lumber, logs, and wood chips to outside markets. The U.S. Forest Service, Oregon State Department of Forestry, and local fire districts provide fire protection.

The principal forest cover in the survey area is the interior Douglas-fir type that typically includes small amounts of western larch, ponderosa pine, grand fir, and lodgepole pine. The grand fir and lodgepole pine types are generally at mid-elevations with the interior Douglas-fir type. The interior ponderosa pine type is at lower elevations, and the Engelmann spruce-subalpine fir type is at higher elevations. Repeated fires in this area once favored the establishment of ponderosa pine and lodgepole pine. Following a half-century of fire control, many such stands are changing to the Douglas-fir type.

The majority of the woodland in the survey area provides forage for livestock and wildlife. The amount of forage available under many timber stands is low, and the palatability may range from low to high. The ponderosa pine types tend to produce high quality bunchgrass if properly managed.

The forested areas in the county are affected by many diseases and insects that may be hazards in individual stands of trees. Damage varies from year to year.

Dwarf mistletoe (Arceuthobium spp.) is one of the most destructive parasites of ponderosa pine, Douglas-fir, and western larch. Laminated root rot (Phylinius weirii) is a major disease for Douglas fir. Red ring rot (Fomes pini) is a major disease for western larch and lodgepole pine. Other diseases at any given time may be hazardous to individual stands of trees. The most serious insect problem is the western spruce budworm (choristoneura occidentalis), which reduces growth dramatically by defoliating Douglas-fir and true firs. The larch casebearer (Coleophora laricella) causes defoliation of western larch. The mountain pine beetle (Dendroctonus ponderosae), the pine engraver (Ips pini), and the red turpentine beetle (Dendroctonus pseudotsugae) periodically kill large numbers of trees and annually kill some trees. The Douglas-fir tussock moth (Hemerocampa pseudotsugata) occasionally builds up large populations and can kill Douglas-fir, grand fir, subalpine fir, and western larch.

Soil surveys are important to woodland managers seeking ways to increase the productivity of their woodlands. Certain soils will respond better to fertilization, some are susceptible to landslides and erosion after road building and harvesting, and others will require special efforts to harvest and reforest.

Table 7 summarizes the forestry information given in the detailed soil map unit descriptions and can serve as a quick reference for woodland interpretations. Map unit symbols are listed in the table, and the site index for each unit is given.

The *potential productivity* of *common trees* on a soil is expressed as a site index. This index is determined by taking height and age measurements on selected trees within stands of a given species (*1, 2, 8, 9, 10, 11, 12, 17, 22*). The site index applies to fully stocked, even-aged stands growing on a particular soil map unit. Generally, the higher the site index for a map unit, the higher the timber yield from that units. Site index can be converted into estimated yields at various ages by using the appropriate yield tables. The common trees shown for each map unit are listed in the order of their abundance.

Species preferred for wood production are those that are planted for reforestation or are allowed to regenerate without planting or seeding. The desired product, the topographic position, and preference are only some of the factors that can influence the choice of adapted trees to use for reforestation.

In table 7, the soils also are rated for a number of factors to be considered in woodland management.

Sheet and rill erosion hazard refers mainly to the erosion occurring as a result of woodland operations where soil is exposed. A rating of *slight* indicates that no particular erosion-control measures are needed under ordinary conditions; *moderate* indicates that some erosion-control measures are needed; and *severe* indicates that extra precautions are needed to control erosion during most silvicultural activities.

The erosion hazard ratings are determined by considering the topography, the erodibility of a soil, and the local climate. Moderate and severe ratings may indicate the need for modified road construction, special harvesting systems, and alternative site preparation techniques.

Cut and fill erosion hazard refers to the damage that results from erosion from road cuts and fills. Seeding cut and fill slopes is always recommended. A rating of *slight* indicates that no other measures are needed under ordinary conditions; *moderate* indicates that further erosion control measures (such as mulching and sediments traps) are needed under certain conditions; and *severe* indicates that further erosion-control measures are needed under most conditions.

The texture of the surface and subsurface layers of a soil, the slope gradient, and the slope length all contribute to the extent of cut and fill erosion. The erosion hazard becomes more severe as cut and fill slopes increase in length and as the erodibility of the soil increases.

The *equipment limitation* ratings refer to the limits on the use of equipment as a result of soil characteristics and slope gradient. A rating of *slight* indicates that equipment use is not normally restricted because of soil factors; *moderate* indicates short seasonal limitation because of soil wetness, a fluctuating water table, or some other factor; and *severe* indicates a seasonal limitation, a need for special equipment, or a hazard in the use of equipment.

Steepness of slope, soil wetness, and the susceptibility of the soil to compaction are the main factors that cause equipment limitations. As slope gradient and length increase, it becomes more difficult to use wheeled equipment. On steeper slopes, tracked equipment must be used. On the steepest slopes cable yarding systems must be used. Soil wetness, especially where the soil material is fine textured, can severely limit the use of equipment and make harvesting practical only during the dry period in summer.

Soil compaction hazard refers to the probability that damage will occur to the soil structure as a result of repeated equipment use during wet or moist conditions. Compaction should always be a concern during silvicultural activities. A *slight* rating indicates the use of designated skid trails and protection of the duff layer are advised; *moderate* indicates the potential need for extra precautions (such as cable yarding in lieu of ground skidding equipment and seasonal restrictions on equipment use); and *severe* indicates the need for extreme caution and possibly some restorative activities (such as ripping or discing) following harvest activities.

Surface layer thickness, coarse fragment content, texture, and plasticity are soil characteristics considered in making the compaction hazard ratings. The ratings assume the soil is in a wet or moist condition. Soil compaction decreases air spaces in the soil. Movement of air and water through the soil thus is reduced, restricting root growth and increasing the risk of surface erosion.

Soil displacement refers to mechanical gouging, scraping, or pushing of the soil from its natural position. Displacement is most often associated with mechanical slash disposal and site preparation. A *slight* rating indicates that equipment use is not restricted and that special precautions are generally not needed; *moderate* indicates that specialized equipment (such as brush rake) is recommended; and *severe* indicates that extreme caution is advised where mechanical methods of slash disposal and site preparation are to be used.

Surface layer thickness, coarse fragment content, slope gradient, and texture are soil characteristics considered in making soil displacement hazard ratings. Removal or mixing of the duff layer and exposure of mineral soil is necessary for natural regeneration of many species. However, where excessive soil displacement has occurred, vegetative recovery rates may be impaired. Prolonged exposure of bare soil may result in increased rates of erosion and further deterioration of the site.

Seedling mortality refers to the probability of death of tree seedlings as influenced by soil or topographic conditions. Plant competition is not considered in this rating. The ratings apply to healthy, dormant seedlings from good stock that are properly planted during a period of sufficient moisture. *Slight* indicates that no problem is expected under normal conditions; *moderate* indicates some problems of mortality can be expected and that extra precautions are advisable; and *severe* indicates that mortality will be high and that extra precautions are essential for successful reforestation.

Soil wetness, droughtiness, and topographic conditions are the main factors for seedling mortality . To offset these concerns, larger than normal planting stock, special site preparation, surface drainage, or reinforcement planting may be needed.

Windthrow hazard considers the soil characteristics that affect the development of tree roots and the ability of the soil to hold trees firmly. A rating of *slight* indicates that trees are not normally blown down by the wind; *moderate* indicates that an occasional tree may be blown down during periods of soil wetness combined with moderate or strong winds; and *severe* indicates that many trees may be blown down during periods when the soil is wet and winds are moderate or strong.

The main factors for restricted rooting depth and resulting windthrow are a high water table and underlying bedrock or other impervious layers. A *slight* rating indicates that little or no special care is needed. A *moderate* or *severe* rating indicates the need for care in thinning forest stands, periodic salvage of windblown trees, and an adequate road and trail system to allow for salvage operations.

Plant competition refers to the likelihood of the invasion of undesirable plants when openings are made in the tree canopy. A *slight* rating indicates that unwanted plants are not likely to retard the development of volunteer or planted seedlings; *moderate* indicates that competition will retard volunteer or planted reforestation; and *severe* indicates that competition can be expected to prevent volunteer or planted reforestation.

The characteristics of the climate and the soil determine the degree of plant competition. In many places, the key to predicting plant competition is determining the quantity and proximity of seed sources of undesirable plants or the quantity of unwanted brush rootstock that will resprout after harvesting. A *slight* indicates that little or no special care is needed. *Moderate* or *severe* indicates the need for careful and thorough site preparation and the potential need for mechanical or chemical treatment to retard growth of competing vegetation.

Fire damage hazard refers to the probability that a fire of moderate fireline intensity (116 to 520 Btu's/sec./ft.) will have a negative impact on the soil characteristics. A rating of *slight* indicates that negative impacts to soil characteristics are not expected; *moderate* indicates that negative impacts (non-wettability and excess erosion) may occur and that extra caution is advised in planning prescribed fires; and *severe* indicates that negative impacts are likely to occur and that extreme caution is advised in planning prescribed fires.

Surface layer thickness, organic matter content, coarse fragment content, and texture are soil characteristics considered in determining the ability of soil to resist fire damage. To offset this hazard, it may be necessary to consider winter burning, alternative lighting techniques, monitoring of fuel moisture content, yarding of unmerchantable material, elimination of prescribed fires, or erosion-control measures following burning.

Windbreaks and Environmental Plantings

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, hold snow on the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. To insure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

Table 8 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 8 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from local offices of the Natural Resources Conservation Service or the Cooperative Extension Service or from a nursery.

Recreation

The soils of the survey area are rated in table 9 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 9, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties generally are favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 9 can be supplemented by other information in this survey; for example, interpretations for dwellings without basements and for local roads and streets in table 10 and interpretations for septic tank absorption fields in table 11.

Camp areas require site preparation such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils are gently sloping and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking and horseback riding should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Wildlife Habitat

By Matthew H. Fillmore, soil scientist, Natural Resources Conservation Service, and Matt Kniesel, wildlife biologist, U.S. Bureau of Land Management.

The Baker County Area ranges from valley bottom land at warm, lower elevations to forested mountains at cold higher elevations. It encompasses varied climatic conditions, topography, land use, and vegetation Such diverse environmental conditions provide many types of wildlife habitat and an abundance of wildlife species.

Water resources occur throughout the survey area in the form of ponds, lakes, reservoirs, rivers, and perennial streams, all of which provide habitat for many species of fish. Representative examples of fish using these sources of water include rainbow trout and brook trout as well as several species of warmwater fish, such as bluegill, crappie, perch, carp, whitefish, suckers, and dace. Also, the Snake River provides excellent habitat for such species as sturgeon, catfish, and bass.

The survey area is habitat for 16 major groupings, or life forms, of terrestrial wildlife (*27*). The 327 species of wildlife in the area can be grouped into the life forms according to habitat requirements and groupings of plant commmunities that wildlife use as habitat (*13, 15, 16*). In this survey area, few species are in life form groupings 1 and 2. Thus, only the descriptions for life forms 3 to 16 are given.

Life form 3: 45 species that reproduce on the ground around water and feed on the ground, in bushes or trees, or in water. Representative species: ducks, geese, swans, shorebirds, and several songbirds.

Life form 4: 32 species that reproduce in cliffs, caves, rimrock, and talus and feed on the ground or in the air. Representative species: chukar, bobcat, common raven, pika, big-horned sheep, mountain goat, and cliff swallow.

Life form 5: 48 species that feed and reproduce on the ground without specific water, cliff, rimrock, or talus association. Representative species: pronghorn antelope, Rocky Mountain elk, mule deer, ruffed grouse, ring-necked pheasant, meadowlark, and marsh hawk.

Life form 6: 7 species that reproduce on the ground and feed in bushes, in trees, or in the air. Representative species: porcupine and common nighthawk.

Life form 7: 30 species that reproduce in bushes and feed on the ground, in water, or in the air. Representative species: numerous songbirds, robin, common egret, red-winged blackbird, and Swainson's hawk.

Life form 8: 6 species that reproduce in bushes and feed in trees, bushes, or in the air. Represenative species: American goldfinch and yellow-breasted chat.

Life form 9: 4 species that reproduce primarily in deciduous trees and feed in trees, in bushes, or in the air. Representative species: cedar waxwing, blue jay, and house finch.

Life form 10: 14 species that reproduce primarily in conifer trees and feed in bushes, in trees, or in the air. Representative species: western gray squirrel, western tanager, and western flycatcher.

Life form 11: 24 species that reproduce in either coniferous or deciduous trees and feed in trees, in bushes, on the ground, or in the air. Representative species: Cooper's hawk, long-eared owl, band-tailed pigeon, common crow, Steller's jay, pine siskin, and rufous hummingbird.

Life form 12: 7 species that reproduce on very thick branches and feed on the ground or in the water. Representative species: golden eagle, bald eagle, red-tailed hawk, and great blue heron.

Life form 13: 13 species that excavate holes in trees for sites for reproducing and feed in trees or bushes, on the ground, or in the air. Representative species: common flicker, downy woodpecker, red-breasted nuthatch, and yellow-bellied sapsucker.

Life form 14: 37 species that reproduce in holes made by other animals or in natural holes and feed on the ground, in water, or in the air. Representative species: wood duck, American kestrel, northern flying squirrel, tree swallow, marten, fisher, raccoon, and mountain bluebird.

Life form 15: 40 species that reproduce in a burrow underground and feed above the ground or underground. Representative species: coyote, black bear, ground squirrels, badger, and skunks.

Life form 16: 10 species that reproduce in a burrow underground and feed in the air or in the water. Representative species: beaver, river otter, belted kingfisher, mink, and muskrat.

The map units shown on the general soil map at the back of this survey have been grouped into five physiographic settings according to their potential to provide similar kinds of wildlife habitat. The five physiographic settings along with the kinds of life forms that inhabit each area are briefly described in the following paragraphs.

Map units 1, 2, 3, 4, and 5.—These units are along the flood plains and low terraces of the Powder and Burnt Rivers and their tributaries as well as along Eagle and Pine Creeks. General soil map units 1, 2, and 3 are in areas that receive 12 inches or less of precipitation annually and have hot, dry summers and cold, moist winters. General soil map units 4 and 5 are in areas that receive more than 12 inches of precipitation annually and have warm, dry summers and cold, moist winters. Wildlife habitat in these map units is provided by riparian vegetation, cultivated crops, and native pasture. The vegetation in areas not cultivated is mainly cottonwood, willow, rushes, and sedges in moist areas and big sagebrush, bunchgrasses, and occasional scattered pine trees in areas of better soil drainage. Salt-tolerant plants, such as saltbush and greasewood, are in areas of general soil map unit 3. Cultivated areas are used for alfalfa and grass-legume hay, irrigated pasture, winter wheat, barley, and field corn.

Representative animals using the habitat types in these map units are primarily life forms 3, 4, 5, 7, 10, 11, 12, 13, 14, 15, and 16.

Map units 6, 7, 11, 12, and 13.—These units are on gently sloping to very steep high terraces and hills in areas that annually receive 12 inches of precipitation or less. Summers are hot and dry, and winters are cold and moist. Representative areas include Virtue Flat, lower elevations in Unity basin, Coyote Point near Haines, Burnt River Canyon, Glasgow Butte, Iron Mountain near Durkee, and lower elevations on Morgan Mountain north of Huntington. The native vegetation is mainly Wyoming big sagebrush, stiff sagebrush, bluebunch wheatgrass, Idaho fescue, Sandberg bluegrass, and Thurber needlegrass.

Representative animals using the habitat types in these map units are primarily life forms 3, 4, 5, 7, 12, and 15.

In the very steep areas of general soil map units 6, 7, and 12, the vegetation is dominated by antelope bitterbrush, basin big sagebrush, gray rabbitbrush, and several species of needlegrass. As the amount of shrubs increases, the abundance and degree of use by wildlife species is reflected by those animals best adapted in utilizing the shrub component of the plant community. Shrub vegetation, because of its structure, creates more habitat niches that are utilized by these wildlife species.

In the very steep areas of general map units 11 and 13, the vegetation is dominated by curlleaf mountainmahogany, antelope bitterbrush, greasebush, some Wyoming big sagebrush, bluebunch wheatgrass, and Sandberg bluegrass. These areas tend to be on or near cliffs or other areas of rock outcrop (such as rimrock or talus).

Map units 8, 10, 14, 15, 17, 18 and 19.—These units are on nearly level to very steep high terraces and hills in areas that receive 12 to 16 inches of precipitation annually and have warm, dry summers and cold, moist winters. Representative areas include Pritchard Flat, Table Rock south of Durkee, Posy Valley near Halfway, the high terraces south of Unity, the Dark Canyon and Windy Ridge areas near the Burnt River Canyon, the Immigrant Gulch area between Richland and Halfway, and areas on Big Lookout Mountain. The native vegetation is mainly mountain big sagebrush, Idaho fescue, antelope bitterbrush, squaw apple, bluebunch wheatgrass, and Sandberg bluegrass and minor amounts of stiff sagebrush, basin big sagebrush, basin wildrye, and wax currant.

In the very steep areas of these general soil map units, the vegetation is dominated by mountain big sagebrush, bluebunch wheatgrass, Sandberg bluegrass, curlleaf mountainmahogany, western juniper, and antelope bitterbrush. These steeper slopes also tend to be on or near areas of rock outcrop, rimrock, or talus. The same species of wildlife inhabit these units as are in the corresponding steeper areas of the map units in the less-than-12-inch precipitation zone.

Map unit 16.—This unit is on gently sloping to steep hills and mountainous areas that receive 16 to 20 inches of precipitation annually and have cool, dry summers and cold, wet winters. Representative areas include Sparta Butte, Pedro Mountain, Big Lookout Mountain, and between China Creek and Cottonwood Buttes north of Unity Reservoir. This unit is a transition zone (edge) between the rangeland and the forests and, as such, provides some of the widest diversity of habitat niches in the survey. The area influenced by the transition between vegetative communities or successional stages is called an ecotone. Edges and their ecotones are usually richer in wildlife than the adjoining plant communities or successional stages (*27*). Habitat types range from nearly open grasslands to shrub-grasslands to a mixture of shrubs and scattered coniferous trees. This variety of habitat allows for a wide diversity in wildlife species, which in turn enhances the richness of the habitat types, or the relative degree of ability of the habitat to produce numbers of species of either plants or animals.

In the gently sloping areas of this general soil map unit, the native vegetation is mainly mountain big sagebrush, squaw apple, antelope bitterbrush, wax currant, buckwheat, bitter cherry, Idaho fescue, and bluebunch wheatgrass and minor amounts of stiff sagebrush, Sandberg bluegrass, and various species of needlegrass. In the steep areas, the vegetation is dominated by mountain big sagebrush, squaw apple, antelope bitterbrush, curlleaf mountainmahogany, western juniper, scattered ponderosa pine, bitter cherry, Idaho fescue, and bluebunch wheatgrass.

Representative animals using the habitat types in this map unit are primarily life forms 4, 5, 7, 12, 15, and 16. Numerous species of wildlife inhabit this map unit since it offers a wide variety of shrubs to utilize as habitat types.

Map units 9, 20, 21, 22, 23, 24, and 25.—These units are on forested landforms in areas that receive 16 to 35 inches of precipitation annually and have cool, moist summers and cold, wet winters. Map unit 9 is on a high stream terrace in Sumpter Valley, and map units 20, 21, 22, 23, 24, and 25 are in mountainous areas such as the Elkhorn Mountains, Hunt Mountain, Pedro Mountain, Big Lookout Mountain, Dooley Mountain, Sugarloaf Mountain, Buck Mountain west of Unity, and Huckleberry Mountain south of Sumpter.

At the lower end of the precipitation range, the native vegetation is mainly ponderosa pine, common snowberry, antelope bitterbrush, spirea, elk sedge, pinegrass, Idaho fescue, heartleaf arnica, and wild strawberry. As the precipitation increases, Douglas-fir and western larch come into the forest canopy on north slopes. The understory vegetation changes to include creambush oceanspray, mallow ninebark, low Oregongrape, princes pine, and myrtle pachystima. At the upper end of the precipitation zone, the forest canopy will be dominated by Douglas-fir, grand fir, and western larch and minor amounts of lodgepole pine, subalpine fir, and Engelmann spruce. The understory is composed mainly of princes pine, myrtle pachystima, elk sedge, pyrola, western rattlesnake plantain, and heartleaf arnica.

Representative wildlife using the habitat types in these map units are primarily life forms 4, 5, 10, 11, 12, 13, 14, 15, and 16.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building Site Development, Sanitary Facilities, Construction Materials, and Water Management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps and soil descriptions, and other data provided in this survey can be use to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

Building Site Development

Table 10 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features generally are favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills generally are limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock or to a cemented pan, the available water capacity in the upper 40 inches, and the content of salts, sodium, and sulfidic materials affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

Table 11 shows the degree and the kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features generally are favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 11 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 11 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage because of rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill — trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 11 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite and transported to the landfill or is from excavations at the site. The soil material is then spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the soil material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to wind erosion.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 12 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a probable or improbable source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel, or both. They have at least 5 feet of suitable material, low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 12, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the taxonomic unit descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a *probable* source has a layer of clean sand or gravel or a layer of sand or gravel that is as much as 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an *improbable* source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils generally is preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water Management

Table 13 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas and embankments, dikes, and levees. The limitations are considered *slight* if soil properties and site features generally are favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even more than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock or to a cemented pan. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of wind or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of wind erosion, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features listed in tables are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help to characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

Engineering Index Properties

Table 14 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 to 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each taxonomic unit under "Taxonomic Units and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages by dry weight of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as 15 percent, an appropriate modifier is added; for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the system adopted by the American Association of State Highway and Transportation Officials (*3*) and the Unified soil classification system (*4*).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification; for example, SP-SM.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

Table 15 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each taxonomic unit under "Taxonomic Units and Their Morphology."

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earth-moving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at ⅓ bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Salinity is a measure of soluble salts in the soil at saturation. It is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of nonirrigated soils. The salinity of irrigated soils is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of soils in individual fields can differ greatly from the value given in the table. Salinity affects the suitability of a soil for crop production, the stability of the soil if used as construction material, and the potential of the soil to corrode metal and concrete.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, more than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, very fine sand, sand, and organic matter (as much as 4 percent) and on soil structure and permeability. The estimates are modified by the presence of rock fragments. Values of K range from 0.02 to 0.69. The higher the value the more susceptible the soil is to sheet and rill erosion.

Erosion factor T is an estimate of the maximum average rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to wind erosion in cultivated areas. The groups indicate the susceptibility of soil to wind erosion and the amount of soil lost. Soils are grouped according to the amount of stable aggregates 0.84 millimeters in size. These are represented idealistically by USDA textural classes. Soils containing rock fragments can occur in any group.

1. Sand, fine sand, and very fine sand. These soils generally are not suitable for crops. They are extremely erodible, and vegetation is difficult to establish on them.

2. Loamy sand, loamy fine sand, and loamy very fine sand. These soils are very highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

3. Sandy loam, coarse sandy loam, fine sandy loam, and very fine sandy loam. These soils are highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible. Crops can be grown if intensive measures to control wind erosion are used.

4. Clay, silty clay, clay loam, and silty clay loam that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control wind erosion are used.

5. Loamy soils that are less than 20 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loam and sandy clay that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control wind erosion are used.

6. Loamy soils that are 20 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loam. These soils are very slightly erodible. Crops can easily be grown.

7. Silty clay loam that is less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible. Crops can easily be grown.

8. Stony or gravelly soils and other soils not subject to wind erosion.

Organic matter is the plant and animal residue in the soil at various stages of decomposition.

In table 15, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter of a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and Water Features

Tables 16 and 17 give estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sand or gravelly sand. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clay that has high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary covering of the soil surface by flowing water, is caused by overflow from streams, by runoff from adjacent slopes, or by inflow from high tides. Shallow water standing or flowing for short periods after rainfall or snowmelt is not considered to be flooding. Standing water in swamps and marshes or in closed depressional areas is considered to be ponding.

Table 16 gives the frequency and duration of flooding and the time of year when flooding is most likely to occur.

Frequency, duration, and probable period of flooding are estimated. Frequency is expressed as *none, rare, occasional,* frequent. *None* means that flooding is not probable, *rare* that it is unlikely but is possible under unusual weather conditions (chance of flooding in any year is 0 to 5 percent), *occasional* that it occurs infrequently under normal weather conditions (chance of flooding in any year is 5 to 50 percent), and *frequent* that it occurs often under normal weather conditions (chance of flooding in any year is more than 50 percent).

Duration is expressed as *very brief* (less than 2 days), *brief* (2 to 7 days), *long* (7 days to 1 month), and *very long* (more than 1 month). The time of year that flooding is most likely to occur is expressed in months. November-May, for example, means that flooding can occur during the period November through May. About two-thirds to three-fourths of all flooding occurs during the stated period.

The information on flooding is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons, which are characteristic of soils that are not subject to flooding.

Also considered are local information about the extent and level of flooding and the relation of each soil on the landscape to historic flood. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 16 are the depth to the seasonal high water table; the kind of water table—that is, *perched, artesian,* or *apparent*; and the months of the year that the water table usually is highest. A water table that is seasonally high for less than 1 month is not indicated in the table.

An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. An *artesian* water table is under hydrostatic head, generally below an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole. A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower water table by a dry zone.

The two numbers in the column "High water table" indicate the normal range in depth to a saturated zone. Depth is given to the nearest half foot. The first numeral in the range indicates the highest water level. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. "More than 6.0" indicates that the water table is below a depth of 6 feet or that the water table exists for less than a month.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is specified as either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

A cemented pan is a cemented or indurated subsurface layer at a depth of 5 feet or less. Such a pan causes difficulty in excavation. Pans are classified as thin or thick. A *thin* pan is one that is less than 3 inches thick if continuously indurated or less than 18 inches thick if discontinuous or fractured. Excavations can be made by trenching machines, backhoes, or small rippers. A *thick* pan is one that is more than 3 inches thick if continuously indurated or more than 18 inches thick if it is discontinuous or fractured. Such a pan is so thick or massive that blasting or special equipment is needed in excavation.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured clayey soils that have a high water table in winter are most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*26*). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 18 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol.* An example is Entisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Aquoll (*Aqu*, meaning water, plus *oll*, from Mollisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Endoaquolls (*Endo*, meaning saturation, plus *aquoll*, the suborder of the Mollisols that have an aquic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Endoaquolls.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, thickness of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-loamy, mixed, nonacid, mesic Typic Endoaquents.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

Taxonomic Units and Their Morphology

In this section, each taxonomic unit recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each unit. A pedon, a small three-dimensional area of soil, that is typical of the unit in the survey area is described. The detailed description of each soil horizon follows standards in the *Soil Survey Manual* (*23*). Many of the technical terms used in the descriptions are defined in *Soil Taxonomy* (*26*). Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the unit.

The map units of each taxonomic unit are described in the section "Detailed Soil Map Units."

Anatone Series

The Anatone series consists of shallow, well drained soils on mountains. These soils formed in colluvium derived from rhyolite, andesite, and basalt. Slope is 12 to 75 percent. Elevation is 4,000 to 6,000 feet. The average annual precipitation is 16 to 30 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 60 to 90 days.

Typical pedon of Anatone extremely stony loam, 12 to 35 percent south slopes, about 0.75 mile east of Beaver Mountain, NE¼SW¼NE¼ sec. 26, T. 11 S., R. 40 E.

A—0 to 8 inches; black (10YR 2/1) extremely stony loam, dark brown (10YR 4/3) dry; weak fine granular structure; slightly hard, very friable, nonsticky and nonplastic; common fine roots; many very fine and fine irregular pores; about 40 percent gravel and 40 percent stones; moderately acid (pH 6.0); clear wavy boundary.

Bw—8 to 16 inches; very dark brown (10YR 2/2) extremely cobbly loam, grayish brown (10YR 4/2) dry; weak fine and medium subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; few fine and medium roots; common fine tubular pores; about 40 percent gravel, 30 percent cobbles, and 10 percent stones; moderately acid (pH 6.0); abrupt wavy boundary.

R—16 inches; rhyolite.

The depth to bedrock is 10 to 20 inches. Hue is 10YR where the soils are underlain by rhyolite and andesite and 7.5YR where the soils are underlain by basalt.

The A horizon has value of 2 or 3 when moist and 4 or 5 when dry and has chroma of 1 or 2 when moist and 2 or 3 when dry. It has 0 to 60 percent gravel, 0 to 10 percent cobbles, and 0 to 40 percent stones.

The Bw horizon has value of 2 or 3 when moist and 3 or 4 when dry and has chroma of 2 or 3 when moist and 2 to 4 when dry. It is loam or silt loam having 10 to 50 percent gravel, 10 to 40 percent cobbles, and 5 to 30 percent stones.

Some pedons have a Cr horizon.

Angelpeak Series

The Angelpeak series consists of deep, well drained soils on mountains. These soils formed in colluvium derived from argillite and influenced by volcanic ash in the surface layer. Slope is 30 to 80 percent. Elevation is 6,200 to 8,500 feet. The average annual precipitation is 30 to 40 inches, the average annual air temperature is 35 to 40 degrees F, and the average frost-free period is 20 to 40 days.

Typical pedon of Angelpeak gravelly silt loam, 30 to 80 percent north slopes, 2,600 feet north and 900 feet east of the southwest corner of sec. 14, T. 9 S., R. 38 E.

Oi—2 inches to 0; partially decomposed pine needles, grass, and moss.

A—0 to 12 inches; dark brown (10YR 3/3) gravelly silt loam, pale brown (10YR 6/3) dry; weak fine subangular blocky structure parting to fine granular; soft, very friable, nonsticky and nonplastic; moderately smeary; many very fine and medium roots; many very fine and fine irregular pores; about 20 percent gravel; slightly acid (pH 6.2); clear smooth boundary.

Bw—12 to 27 inches; dark brown (10YR 4/3) gravelly loam, very pale brown (10YR 7/4) dry; weak fine and medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; moderately smeary; common fine and few medium and coarse roots; common fine and medium tubular pores; about 30 percent gravel; slightly acid (pH 6.2); abrupt wavy boundary.

2C1—27 to 47 inches; brown (10YR 4/3) extremely gravelly loam, pale brown (10YR 6/3) dry; massive; slightly hard, firm, nonsticky and nonplastic; common very fine and fine roots; common very fine and fine tubular pores; about 70 percent gravel; slightly acid (pH 6.4); clear wavy boundary.

2C2—47 to 58 inches; brown (10YR 4/3) extremely gravelly sandy loam, light brownish gray (10YR 6/2) dry; massive; soft, friable, nonsticky and nonplastic; few very fine roots; few very fine irregular pores; about 80 percent gravel; neutral (pH 6.6); clear wavy boundary.

R—58 inches; argillite.

The depth to bedrock is typically 40 to 60 inches but is more than 60 inches in some pedons. Depth to the contrasting horizon is 15 to 30 inches.

The A horizon has value of 2 to 4 when moist and 5 to 7 when dry and has chroma of 3 or 4 when moist or dry. It has 10 to 20 percent gravel and 0 to 10 percent cobbles.

The Bw horizon has value of 3 or 4 when moist and 6 or 7 when dry and has chroma of 3 or 4 when moist or dry. It is loam or silt loam. It has 20 to 30 percent gravel. It is weakly smeary or moderately smeary.

The 2C horizon has value of 4 or 5 when moist and 6 or 7 when dry and has chroma of 2 to 4 when moist or dry. It is loam or sandy loam having 60 to 70 percent gravel and 0 to 15 percent cobbles.

Applegate Series

The Applegate series consists of deep, well drained soils on foot slopes, fans, and gently sloping terraces. These soils formed in alluvium and colluvium. Slope is 2 to 15 percent. Elevation is 2,500 to 3,600 feet. The average annual precipitation is 18 to 22 inches, the average annual air temperature is 45 to 48 degrees F, and the average frost-free period is 100 to 130 days.

Typical pedon of Applegate silt loam, 7 to 15 percent slopes, about 1 mile south of Carson and 4 miles northwest of Halfway, NW¼NE¼NE¼ sec. 35, T. 7 S., R. 45 E.

A1—0 to 6 inches; dark brown (7.5YR 3/2) silt loam, brown (7.5YR 4/2) dry; moderate fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; common very fine and fine tubular and irregular pores; neutral (pH 6.8); clear smooth boundary.

A2—6 to 11 inches; dark brown (7.5YR 3/2) silt loam, brown (7.5YR 4/4) dry; moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; common very fine, fine, and medium tubular pores; neutral (pH 6.6); gradual smooth boundary.

BA—11 to 28 inches; dark reddish brown (5YR 3/4) silty clay loam, brown (7.5YR 4/4) dry; moderate medium subangular blocky structure; hard, friable, sticky and plastic; few very fine and fine roots; common very fine and fine and few medium tubular pores; slightly acid (pH 6.4); gradual smooth boundary.

Bt1—28 to 45 inches; dark reddish brown (5YR 3/4) clay, brown (7.5YR 5/4) dry; moderate medium and coarse subangular blocky structure; hard, friable, sticky and plastic; few very fine roots; many fine tubular pores; common faint clay films on faces of peds; slightly acid (pH 6.2); gradual smooth boundary.

Bt2—45 to 60 inches; dark reddish brown (5YR 3/4) clay, brown (7.5YR 5/4) dry; weak fine and medium subangular blocky structure; hard, friable, sticky and plastic; many very fine and fine tubular pores; few faint clay films on faces of peds; slightly acid (pH 6.2).

The depth to bedrock is typically more than 60 inches but is 40 to 60 inches in some pedons. The mollic epipedon is 10 to 20 inches thick.

The A horizon has hue of 7.5YR or 10YR, value of 2 or 3 when moist and 3 or 4 when dry, and chroma of 2 when moist and 2 to 4 when dry.

The Bt horizon has hue of 5YR or 7.5YR, value of 3 when moist and 4 or 5 when dry, and chroma of 2 to 4 when moist. It is silty clay loam, silty clay, or clay having 35 to 50 percent clay.

Aridic Haploxerolls

These are deep, well drained soils on alluvial fans. They formed in mixed colluvium and alluvium. Slope is 2 to 12 percent. Elevation is 1,800 to 3,400 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 150 days.

Typical pedon of Aridic Haploxerolls, 2 to 12 percent slopes, 3,400 feet east and 2,600 feet north of the southwest corner of sec. 28, T. 6 S., R. 48 E.

A1—0 to 10 inches; very dark brown (10YR 2/2) very stony loam, dark brown (10YR 4/3) dry; moderate fine and medium granular structure; soft, friable, nonsticky and nonplastic; common very fine and fine roots; common very fine and fine pores; about 15 percent gravel, 15 percent cobbles, and 10 percent stones; neutral (pH 6.8); clear smooth boundary.

A2—10 to 22 inches; very dark brown (10YR 2/2) very cobbly loam, dark brown (10YR 4/3) dry; weak medium and fine subangular blocky structure parting to weak granular; soft, friable, nonsticky and nonplastic; common very fine and fine roots; common very fine and fine pores; about 20 percent gravel, 15 percent cobbles, and 5 percent stones; neutral (pH 7.0); clear smooth boundary.

Bw1—22 to 31 inches; dark brown (7.5YR 3/2) very stony clay loam, brown (7.5YR 4/4) dry; moderate medium subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; common very fine roots; common very fine pores; about 10 percent gravel, 15 percent cobbles, and 20 percent stones; neutral (pH 7.2); clear smooth boundary.

Bw2—31 to 60 inches; dark brown (7.5YR 3/4) very stony clay loam, brown (7.5YR 4/4) dry; moderate medium subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; few very fine roots; about 20 percent gravel, 15 percent cobbles, and 10 percent stones; neutral (pH 7.2).

The depth to bedrock is more than 60 inches.

The A horizon has value of 2 or 3 when moist and 4 or 5 when dry and has chroma of 2 or 3 when moist or dry. It has 5 to 35 percent gravel, 5 to 35 percent cobbles, and 5 to 30 percent stones.

The B horizon has hue of 10YR or 7.5YR, value of 3 or 4 when moist or dry, and chroma of 3 or 4 when moist or dry. It is loam, clay loam, or sandy loam having 10 to 30 percent gravel, 10 to 35 percent cobbles, and 10 to 35 percent stones.

Ateron Series

The Ateron series consists of shallow, well drained soils on hills. These soils formed in colluvium derived from basalt and greenstone. Slope is 2 to 60 percent. Elevation is 3,600 to 5,700 feet. The average annual precipitation is 12 to 16 inches, the average annual air

temperature is 40 to 45 degrees F, and the average frost-free period is 50 to 95 days.

Typical pedon of Ateron very stony loam, 12 to 35 percent south slopes, about 5 miles southeast of Baker on a radio tower road, in the northwest corner of NE¼SE¼ sec. 36, T. 9 S., R. 40 E.

A1—0 to 6 inches; very dark gray (10YR 3/1) very stony loam, dark gray (10YR 4/1) dry; moderate fine granular structure; soft, friable, slightly sticky and slightly plastic; common fine roots; many very fine irregular and tubular pores; about 25 percent stones, 10 percent cobbles, and 10 percent gravel; neutral (pH 7.0); clear wavy boundary.

A2—6 to 12 inches; very dark grayish brown (10YR 3/2) very cobbly silty clay loam, dark grayish brown (10YR 4/2) dry; moderate medium subangular blocky structure parting to moderate medium granular; slightly hard, friable, slightly sticky and slightly plastic; common fine roots; common fine tubular and irregular pores; about 25 percent cobbles and 15 percent gravel; neutral (pH 7.2); clear smooth boundary.

Bt—12 to 17 inches; dark brown (10YR 3/3) very cobbly clay, brown (10YR 4/3) dry; strong coarse subangular blocky structure; hard, firm, sticky and plastic; few fine roots; common fine tubular pores; many prominent clay films on faces of peds; about 30 percent cobbles and 10 percent gravel; neutral (pH 7.2); abrupt smooth boundary.

2R—17 inches; hard basalt.

The depth to bedrock is 10 to 20 inches. Reaction is neutral throughout the solum.

The A1 horizon has value of 2 or 3 when moist and 4 or 5 when dry and has chroma of 1 or 2 when moist and 1 to 3 when dry. It is extremely gravelly clay loam or very stony loam. The extremely gravelly clay loam is generally associated with greenstone, and the very stony loam overlies basalt. This horizon has 10 to 60 percent gravel, 5 to 20 percent cobbles, and 0 to 35 percent stones.

The A2 horizon has value of 2 or 3 when moist and 4 or 5 when dry and has chroma of 2 or 3 when moist or dry. It is silty clay loam or clay loam having 10 to 60 percent gravel, 10 to 35 percent cobbles, and 0 to 20 percent stones.

The Bt horizon has hue of 10YR or 7.5YR. It has value of 2 to 4 when moist and 3 to 5 when dry and has chroma of 3 or 4 when moist or dry. It has 10 to 30 percent gravel, 20 to 60 percent cobbles, and 0 to 20 percent stones. The content of clay is 40 to 50 percent. The structure is moderate or strong, medium or coarse, and angular or subangular blocky.

Bakeoven Series

The Bakeoven series consists of very shallow, well drained soils on hills. These soils formed in loess and in colluvium derived from basalt. Slope is 2 to 12 percent. Elevation is 2,000 to 3,600 feet. The average annual precipitation is 10 to 12 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 130 days.

Typical pedon of Bakeoven extremely gravelly loam, in an area of Bakeoven-Ruckles complex, 2 to 12 percent slopes, 100 feet north and 250 feet east of the southwest corner of sec. 5, T. 10 S., R. 46 E.

A—0 to 2 inches; very dark grayish brown (10YR 3/2) extremely gravelly loam, brown (10YR 5/3) dry; moderate fine granular structure; soft, friable, nonsticky and nonplastic; many very fine and fine roots; many very fine and fine tubular pores; about 55 percent gravel, 20 percent cobbles, and 5 percent stones; neutral (pH 6.8); clear smooth boundary.

BA—2 to 5 inches; dark brown (10YR 3/3) extremely cobbly clay loam, brown (10YR 5/3) dry; moderate fine and medium subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; common very fine and fine roots; common very fine and fine tubular pores; about 60 percent cobbles and 10 percent gravel; neutral (pH 6.8); clear smooth boundary.

Bw—5 to 8 inches; dark brown (10YR 3/3) extremely cobbly clay loam, brown (10YR 4/3) dry; moderate medium subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; common very fine roots; common very fine tubular pores; about 60 percent cobbles and 10 percent gravel; neutral (pH 6.8); abrupt wavy boundary.

2R—8 inches; basalt.

The depth to bedrock is 4 to 10 inches. Hue is 10YR or 7.5YR.

The A horizon has value of 2 or 3 when moist and 4 or 5 when dry and has chroma of 2 or 3 when moist or dry. It has 40 to 60 percent gravel, 10 to 15 percent cobbles, and 5 to 10 percent stones.

The Bw horizon has value of 2 or 3 when moist and 4 or 5 when dry and has chroma of 3 or 4 when moist or dry. It is loam, clay loam, or silty clay loam having 40 to 60 percent cobbles and 10 to 20 percent gravel.

Baker Series

The Baker series consists of well drained soils on low terraces. These soils are moderately deep to a duripan. They formed in old alluvial sediments influenced by mixed volcanic ash and loess. Slope is 0 to 7 percent. Elevation is 2,000 to 3,500 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 110 to 140 days.

Typical pedon of Baker silt loam, 2 to 7 percent slopes, about 3 miles south of North Powder, 300 feet west and 200 feet south of the northeast corner of sec. 3, T. 7 S., R. 39 E.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak thin platy and weak fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; many very fine irregular pores; neutral (pH 7.0); abrupt smooth boundary.

BA—8 to 11 inches; dark brown (10YR 3/3) silt loam, brown (10YR 5/3) dry; weak coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; common very fine tubular pores; mildly alkaline (pH 7.4); clear smooth boundary.

Bw—11 to 16 inches; brown (10YR 3/3) silt loam, brown (10YR 5/3) dry; weak medium and coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; common very fine tubular pores; few firm nodules 1/4 to 1/2 inch in diameter; moderately alkaline (pH 8.0); clear smooth boundary.

Bk1—16 to 23 inches; brown (10YR 4/3) loam, pale brown (10YR 6/3) dry; massive; hard, firm, slightly sticky and slightly plastic; few very fine roots; common very fine tubular pores; common firm nodules 1/4 to 1/2 inch in diameter; slightly effervescent; strongly alkaline (pH 8.6); gradual wavy boundary.

Bk2—23 to 31 inches; brown (10YR 5/3) loam, pale brown (10YR 6/3) dry; massive; hard, firm, slightly sticky and slightly plastic; few very fine roots; few fine tubular pores; few firm nodules 1/4 to 1/2 inch in diameter; strongly effervescent; strongly alkaline (pH 8.6); abrupt wavy boundary.

2Bkqm—31 to 39 inches; pinkish gray (7.5YR 7/2), silica-cemented duripan; indurated plates; weakly cemented, calcareous loamy sand between the plates; massive; extremely hard; laminar capping on surface and in fractures; violently effervescent; strongly alkaline (pH 8.8); abrupt wavy boundary.

2Bq—39 to 60 inches; multicolored extremely gravelly sand; massive; hard, firm, nonsticky and nonplastic; weakly cemented; about 55 percent gravel and 10 percent cobbles; mildly alkaline (pH 7.6).

The depth to bedrock is more than 60 inches. Depth to the duripan is 20 to 40 inches.

The Ap horizon has value of 4 or 5 when dry and 2 or 3 when moist and has chroma of 2 or 3 when moist or dry.

The Bw horizon has value of 4 to 6 when dry and 3 or 4 when moist and has chroma of 2 or 3 when moist or dry. It is silt loam or loam. It is neutral to moderately alkaline.

The Bk horizon has value of 5 or 6 when dry and 4 or 5 when moist and has chroma of 3 or 4 when moist or dry. It is silt loam or loam. It is slightly effervescent to violently effervescent.

The 2Bkqm horizon is indurated to strongly cemented. The 2Bq horizon has a fine-earth fraction of loam, loamy sand, or sand. It has 0 to 60 percent gravel and 0 to 10 percent cobbles. It is weakly cemented to strongly cemented.

Baldock Series

The Baldock series consists of deep, poorly drained soils on flood plains. These soils formed in mixed alluvium. Slope is 0 to 2 percent. Elevation is 2,000 to 3,600 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 110 to 140 days.

Typical pedon of Baldock silt loam, 0 to 2 percent slopes, 2.5 miles north of Baker Airport, in the southeast corner of SW1/4 sec. 9, T. 8 S., R. 40 E.

Ak1—0 to 2 inches; very dark grayish brown (10YR 3/2) silt loam, gray (10YR 5/1) dry; moderate very fine and fine granular structure; hard, firm, slightly sticky and slightly plastic; many fine and few medium roots; common very fine and fine tubular and irregular pores; strongly effervescent; moderately alkaline (pH 8.4); abrupt smooth boundary.

Ak2—2 to 6 inches; very dark gray (10YR 3/1) silt loam, gray (10YR 5/1) dry; weak fine and medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common fine and few medium roots; few fine and medium tubular pores; strongly effervescent; moderately alkaline (pH 8.4); abrupt smooth boundary.

AC—6 to 18 inches; dark gray (10YR 4/1) silt loam, gray (10YR 6/1) dry; weak fine and medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few fine roots; common very fine and fine tubular pores; moderately alkaline (pH 8.4); gradual smooth boundary.

C—18 to 36 inches; dark gray (10YR 4/1) silt loam, gray (10YR 6/1) dry; few fine distinct yellowish brown (10YR 5/4) mottles; massive; hard, friable, slightly sticky and slightly plastic; common fine and medium tubular pores; mildly alkaline (pH 7.4); gradual smooth boundary.

Cg—36 to 60 inches; dark grayish brown (2.5YR 4/2) silt loam, light brownish gray (2.5YR 6/2) dry; common fine distinct yellowish brown (10YR 6/6) mottles; massive; hard, friable, slightly sticky and slightly plastic; few very fine and fine tubular pores; about 5 percent gravel; mildly alkaline (pH 7.6).

The depth to bedrock is more than 60 inches.

The Ak and AC horizons have value of 3 or 4 when moist and 5 or 6 when dry and have chroma of 1 or 2 when moist or dry. The content of clay is 20 to 27 percent. Reaction is mildly alkaline to strongly alkaline.

The C and Cg horizons have hue of 10YR or 2.5YR, value of 4 or 5 when moist and 6 or 7 when dry, and chroma of 1 or 2 when moist or dry. They are silt loam, loam, or fine sandy loam having 0 to 15 percent gravel. They are mildly alkaline or moderately alkaline.

Baldridge Series

The Baldridge series consists of deep, well drained soils on mountains. These soils formed in colluvium derived from rhyolite and andesite. Slope is 12 to 70 percent. Elevation is 4,000 to 6,000 feet. The average annual precipitation is 16 to 20 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 60 to 90 days.

Typical pedon of Baldridge very gravelly loam, 50 to 70 percent south slopes, about 0.25 mile east of the Dooley Mountain highway, in the northwest corner of SW¼SE¼NE¼ sec. 17, T. 12 S., R. 40 E.

A1—0 to 7 inches; very dark brown (10YR 2/2) very gravelly loam, dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure parting to weak fine granular; slightly hard, very friable, nonsticky and slightly plastic; many very fine and fine roots; many very fine and fine irregular pores; about 50 percent gravel; neutral (pH 7.0); clear wavy boundary.

A2—7 to 14 inches; very dark brown (10YR 2/2) very gravelly loam, grayish brown (10YR 5/2) dry; weak fine and medium subangular blocky structure; slightly hard, very friable, nonsticky and slightly plastic; many very fine and fine roots; many very fine and fine and few medium and coarse tubular pores; about 40 percent gravel; neutral (pH 7.2); clear wavy boundary.

Bw1—14 to 23 inches; very dark grayish brown (10YR 3/2) very gravelly loam, grayish brown (10YR 5/2) dry; weak fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; common very fine and fine and few medium and coarse roots; many very fine and few medium and coarse tubular pores; about 40 percent gravel and 5 percent cobbles; neutral (pH 7.2); gradual wavy boundary.

Bw2—23 to 30 inches; very dark grayish brown (10YR 3/2) very gravelly loam, grayish brown (10YR 5/2) dry; weak medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; common fine and few medium and coarse roots; common very fine and fine tubular pores; about 45 percent gravel and 15 percent cobbles; neutral (pH 7.2); gradual wavy boundary.

Bw3—30 to 47 inches; dark grayish brown (10YR 4/2) extremely cobbly loam, yellowish brown (10YR 5/4) dry; weak subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; common very fine and fine and few coarse and very coarse roots; common fine and medium tubular pores; about 45 percent gravel and 35 percent cobbles; neutral (pH 6.8); clear wavy boundary.

C—47 to 60 inches; light brownish gray (10YR 6/2) extremely cobbly sandy loam, light gray (10YR 7/2) dry; massive; slightly hard, very friable, nonsticky and nonplastic; few fine and medium roots; common fine tubular pores; about 25 percent gravel and 45 percent cobbles; neutral (pH 6.8).

The depth to bedrock is typically more than 60 inches but is 40 to 60 inches in some pedons. The mollic epipedon is 20 to 35 inches thick.

The A horizon has value of 2 or 3 when moist and 3 to 5 when dry and has chroma of 1 or 2 when moist and 2 or 3 when dry. It has 20 to 60 percent gravel, 0 to 10 percent cobbles, and 0 to 15 stones.

The Bw horizon has value of 3 or 4 when moist and 5 or 6 when dry and has chroma of 2 or 3 when moist and 2 to 4 when dry. It has 25 to 60 percent gravel, 0 to 45 percent cobbles, and 0 to 20 percent stones.

The C horizon has value of 4 to 6 when moist and 6 or 7 when dry and has chroma of 2 or 3 when moist or dry. It is loam or sandy loam having 20 to 60 percent gravel, 10 to 45 percent cobbles, and 0 to 55 percent stones.

Balm Series

The Balm series consists of deep, somewhat poorly drained soils on flood plains. These soils formed in stratified, mixed alluvium. Slope is 0 to 3 percent. Elevation is 2,000 to 3,400 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 47 to 51 degrees F, and the average frost-free period is 120 to 140 days.

Typical pedon of Balm loam, 0 to 3 percent slopes, 2 miles southwest of Richland, 900 feet east and 200 feet south of the northwest corner of sec. 35, T. 9 S., R. 45 E.

A1—0 to 2 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; soft, friable, slightly sticky and slightly plastic; many very fine roots; many very fine tubular and irregular pores; slightly effervescent; moderately alkaline (pH 8.4); clear smooth boundary.

A2—2 to 12 inches; very dark brown (10YR 2/2) silt loam, dark grayish brown (10YR 4/2) dry; weak medium subangular blocky structure; soft, friable, slightly sticky and slightly plastic; common very fine roots; many very fine to large tubular pores; strongly effervescent; moderately alkaline (pH 8.4); clear smooth boundary.

AC—12 to 17 inches; dark brown (10YR 3/3) silt loam, brown (10YR 5/3) dry; common fine distinct reddish brown (5YR 4/4) mottles; massive; soft, friable, slightly sticky and slightly plastic; few roots; few large pores; slightly effervescent; moderately alkaline (pH 8.4); clear smooth boundary.

C1—17 to 23 inches; dark olive gray (5Y 3/2) silt loam, pale brown (10YR 6/3) dry; many large distinct reddish brown (5YR 4/4) mottles; massive; soft, friable, slightly sticky and slightly plastic; few roots; few medium pores; neutral (pH 7.0); clear smooth boundary.

C2—23 to 30 inches; very dark gray (5Y 3/1) fine sandy loam, gray (5Y 5/1) dry; single grain; soft, friable, nonsticky and nonplastic; neutral (pH 6.8); gradual smooth boundary.

2C3—30 to 60 inches; multicolored very gravelly sand; single grain; loose, nonsticky and nonplastic; neutral (pH 6.8).

The depth to bedrock is more than 60 inches. Depth to the 2C horizon is 20 to 40 inches. The upper part of the control section is calcareous.

The A horizon has value of 2 or 3 when moist and 4 or 5 when dry and has chroma of 1 or 2 when moist or dry. It has 0 to 15 percent gravel.

The AC horizon has value of 3 when moist and 4 or 5 when dry and has chroma of 2 or 3 when moist or dry. It is loam or silt loam having 0 to 15 percent gravel.

The C horizon has hue of 10YR to 5Y, value of 3 or 4 when moist and 4 to 6 when dry, and chroma of 1 to 3 when moist or dry. It is loam, silt loam, or fine sandy loam having 0 to 15 percent gravel.

The 2C horizon is loamy sand or sand having 35 to 60 percent gravel and 0 to 10 percent cobbles.

Barnard Series

The Barnard series consists of well drained soils on terraces. These soils are moderately deep to a duripan. They formed in alluvial sediments that are influenced by volcanic ash in the surface layer. Slope is 2 to 20 percent. Elevation is 2,300 to 3,500 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 47 to 51 degrees F, and the average frost-free period is 100 to 140 days.

Typical pedon of Barnard silt loam, 2 to 7 percent slopes, about 2 miles west of Richland, 100 feet west and 25 feet south of the northeast corner of sec. 21, T. 9 S., R. 45 E.

A—0 to 7 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak thin platy structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; common very fine tubular pores; neutral (pH 7.2); clear smooth boundary.

AB—7 to 14 inches; dark brown (10YR 3/3) silty clay loam, brown (10YR 5/3) dry; weak thin platy structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; common very fine and fine tubular pores; few krotovinas; neutral (pH 7.2); clear smooth boundary.

2Bt—14 to 22 inches; dark brown (7.5YR 4/4) silty clay, brown (7.5YR 5/4) dry; weak fine prismatic structure parting to moderate medium subangular blocky; very hard, firm, very sticky and very plastic; common very fine and fine roots; common very fine tubular pores; common distinct clay films on faces of peds; few mycelial threads of calcium carbonate in the lower part; mildly alkaline (pH 7.4); abrupt smooth boundary.

2Bkqm—22 to 30 inches; brown (10YR 4/2), indurated hardpan, white (10YR 8/2) dry; platy; extremely hard and extremely firm; laminar capping on surface and on plates; strongly effervescent; moderately alkaline (pH 8.4); abrupt wavy boundary.

3C—30 to 60 inches; pale brown (10YR 6/3) very gravelly loam, very pale brown (10YR 8/3) dry; massive; very hard, firm, nonsticky and nonplastic; about 35 percent gravel and 10 percent cobbles; moderately alkaline (pH 8.4).

Depth to the duripan is 20 to 40 inches. The depth to secondary lime is 20 to 30 inches.

The A horizon has value of 2 or 3 when moist and 4 or 5 when dry and has chroma of 2 or 3 when moist or dry. The structure is granular or platy. This horizon is silt loam or cobbly silt loam having 0 to 25 percent cobbles and 0 to 10 percent gravel.

The 2Bt horizon has hue of 7.5YR or 10YR, value of

3 or 4 when moist and 5 or 6 when dry, and chroma of 2 to 4 when moist or dry. It is silty clay loam, silty clay, or clay having 35 to 50 percent clay.

The 2Bkqm horizon is indurated throughout or is indurated in the upper few inches and weakly cemented to strongly cemented in the lower part. It is massive or platy. The duripan is 6 to 24 inches thick.

The 3C horizon to a depth of 60 inches or more is stratified alluvium. It has 10 to 35 percent gravel and 10 to 20 percent cobbles.

Benderly Series

The Benderly series consists of deep, somewhat excessively drained soils on alluvial fans. These soils formed in mixed alluvium. Slope is 0 to 7 percent. Elevation is 3,400 to 3,800 feet. The average annual precipitation is 12 to 16 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 130 days.

Typical pedon of Benderly gravelly fine sandy loam, 0 to 7 percent slopes, 0.5 mile west of Pocahontas Road and 20 feet north of Bendier Road, in the southeast corner of SE¼SW¼ sec. 19, T. 8 S., R. 39 E.

A1—0 to 6 inches; very dark grayish brown (10YR 3/2) gravelly fine sandy loam, dark grayish brown (10YR 4/2) dry; weak fine and medium granular structure; soft, friable, nonsticky and nonplastic; many fine roots; many fine irregular pores; about 20 percent gravel and 2 percent cobbles; neutral (pH 7.0); gradual wavy boundary.

A2—6 to 16 inches; dark brown (10YR 3/3) gravelly fine sandy loam, brown (10YR 5/3) dry; weak fine and medium subangular blocky structure; soft, friable, nonsticky and nonplastic; common fine and few medium roots; common fine tubular pores; about 25 percent gravel; neutral (pH 7.2); abrupt wavy boundary.

2C1—16 to 21 inches; dark brown (10YR 3/3) extremely gravelly sand, brown (10YR 5/3) dry; single grain; loose, friable, nonsticky and nonplastic; few fine and medium roots; common fine tubular pores; about 55 percent gravel and 10 percent cobbles; mildly alkaline (pH 7.4); abrupt wavy boundary.

2C2—21 to 60 inches; brown (10YR 4/3) extremely gravelly sand, pale brown (10YR 6/3) dry; single grain; loose, friable, nonsticky and nonplastic; very few fine roots; common fine tubular pores; about 50 percent gravel and 20 percent cobbles; mildly alkaline (pH 7.6).

The depth to bedrock is more than 60 inches. Depth to the extremely gravelly substratum is 10 to 20 inches.

The A horizon has value of 2 or 3 when moist and 4 or 5 when dry and has chroma of 1 or 2 when moist or dry. It has 15 to 30 percent gravel and 0 to 5 percent cobbles.

The 2C horizon has value of 3 or 4 when moist and 5 or 6 when dry and has chroma of 2 to 4 when moist or dry. It is loamy sand or sand having 40 to 60 percent gravel and 5 to 25 percent cobbles.

Boiler Series

The Boiler series consists of deep, well drained soils on mountains. These soils formed in colluvium derived from tuffaceous sediments. Slope is 35 to 60 percent. Elevation is 4,000 to 5,000 feet. The average annual precipitation is 16 to 30 inches, the average annual temperature is 40 to 45 degrees F, and the average frost-free period is 30 to 50 days.

Typical pedon of Boiler gravelly loam, 35 to 60 percent north slopes, NW¼SE¼SW¼ sec. 31, T. 11 S., R. 37 E.

Oi—1 inch to 0; partially decomposed litter of twigs, needles, and leaves.

A1—0 to 6 inches; very dark grayish brown (10YR 3/2) gravelly loam, grayish brown (10YR 5/2) dry; weak very fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine and few medium roots; many very fine and fine tubular pores; about 25 percent gravel and 5 percent cobbles; slightly acid (pH 6.4); clear smooth boundary.

A2—6 to 13 inches; dark brown (10YR 3/3) very gravelly clay loam, brown (10YR 5/3) dry; moderate very fine and fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine and few medium roots; many very fine and fine random tubular pores; about 40 percent gravel and 5 percent cobbles; neutral (pH 6.6); abrupt smooth boundary.

2Bt1—13 to 25 inches; brown (10YR 4/3) extremely gravelly silty clay, brown (10YR 5/3) dry; moderate fine and medium subangular blocky structure; hard, firm, sticky and plastic; common fine and few medium roots; common very fine and fine tubular pores; common distinct clay films on faces of peds and lining pores; about 60 percent gravel; neutral (pH 6.8); abrupt wavy boundary.

3Bt2—25 to 49 inches; dark yellowish brown (10YR 4/4) extremely gravelly clay, yellowish brown (10YR 5/4) dry; strong medium prismatic structure; very hard, very firm, very sticky and very plastic; common very fine tubular pores; many prominent clay films on faces of peds; about 60 percent gravel and 5

percent cobbles; neutral (pH 6.8); abrupt smooth boundary.
4Cr—49 inches; weathered tuffaceous sediments.

The depth to paralithic contact is more than 40 inches. The mollic epipedon is 10 to 20 inches thick. Reaction is slightly acid or neutral throughout the solum.

The A horizon has value of 2 or 3 when moist and 3 to 5 when dry and has chroma of 1 to 3 when moist or dry. It has 15 to 25 percent gravel and 0 to 5 percent cobbles or stones.

The 2Bt1 horizon has value of 3 or 4 when moist and 4 or 5 when dry and has chroma of 3 or 4 when moist or dry. It is silty clay or clay having 50 to 60 percent clay. It has 40 to 60 percent gravel and 0 to 10 percent cobbles. It generally has moderate or strong angular or subangular blocky structure, but in some pedons it grades to moderate or strong prismatic.

The 3Bt2 horizon has textures, colors, and a content of rock fragments similar to those of the 2Bt horizon. The structure is coarse angular blocky or medium or coarse prismatic.

Bouldrock Series

The Bouldrock series consists of moderately deep, well drained soils on hills and mountains. These soils formed in colluvium and residuum derived from quartz diorite and related granitic rocks. Slope is 12 to 80 percent. Elevation is 4,000 to 6,200 feet. The average annual precipitation is 16 to 20 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 70 to 100 days.

Typical pedon of Bouldrock loam, 12 to 35 percent south slopes, 1,300 feet north and 600 feet west of the southeast corner of sec. 14, T. 13 S., R. 42 E.

A—0 to 6 inches; black (10YR 2/1) loam, dark grayish brown (10YR 4/2) dry; weak fine and medium subangular blocky structure parting to weak fine granular; soft, very friable, nonsticky and nonplastic; many very fine and fine roots; many very fine and fine irregular pores; about 5 percent gravel; neutral (pH 6.8); clear smooth boundary.
Bw1—6 to 15 inches; very dark brown (10YR 2/2) sandy loam, dark grayish brown (10YR 4/2) dry; moderate fine and medium subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; many very fine and fine roots; many very fine and fine tubular pores; neutral (pH 6.6); clear smooth boundary.
Bw2—15 to 21 inches; very dark grayish brown (10YR 3/2) sandy loam, dark brown (10YR 3/3) dry; moderate medium subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; many very fine and fine roots; many very fine and fine continuous tubular pores; neutral (pH 6.6); gradual smooth boundary.
C—21 to 32 inches; dark brown (10YR 3/3) sandy loam, brown (10YR 4/3) dry; massive; soft, very friable, nonsticky and nonplastic; common very fine and fine roots; common very fine and fine tubular pores; slightly acid (pH 6.4); gradual wavy boundary.
Cr—32 inches; highly weathered quartz diorite.

The depth to bedrock is 20 to 40 inches.

The A horizon has value of 2 or 3 when moist and 4 or 5 when dry and has chroma of 1 to 3 when moist or dry. It is loam or very bouldery loam having 0 to 10 percent gravel, 0 to 10 percent cobbles, 0 to 30 percent stones, and 0 to 30 percent boulders.

The Bw horizon has value of 2 or 3 when moist and 4 or 5 when dry and has chroma of 2 or 3 when moist or dry. It is loam or sandy loam having 0 to 15 percent gravel.

The C horizon has chroma of 3 or 4 when moist or dry. It is sandy loam or loamy sand having 0 to 20 percent gravel.

Boyce Series

The Boyce series consists of deep, poorly drained soils on flood plains. These soils formed in stratified, mixed alluvium. Slope is 0 to 2 percent. Elevation is 2,000 to 3,600 feet. The average annual precipitation is 10 to 12 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 120 to 140 days.

Typical pedon of Boyce silt loam, 0 to 2 percent slopes, about 1 mile northwest of Richland, NE¼NW¼SE¼ sec. 15, T. 9 S., R. 45 E.

A1—0 to 4 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure parting to fine and very fine granular; soft, friable, nonsticky and nonplastic; many very fine and fine roots; few very fine pores; moderately alkaline (pH 8.0); clear smooth boundary.
A2—4 to 10 inches; very dark grayish brown (10YR 3/2) silt loam, brown (10YR 5/3) dry; few fine faint grayish brown (10YR 5/2) and common fine distinct strong brown (7.5YR 4/6) mottles; moderate medium and fine subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; common very fine and fine roots; few very fine pores; slightly effervescent; moderately alkaline (pH 8.2); clear smooth boundary.
A3—10 to 29 inches; very dark grayish brown (10YR

3/2) silt loam, brown (10YR 5/3) dry; many fine distinct strong brown (7.5YR 4/6) and few medium faint grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; few very fine roots; few very fine pores; neutral (pH 7.2); abrupt smooth boundary.

2C1—29 to 37 inches; dark brown (10YR 3/3) gravelly loamy sand; many medium distinct strong brown (7.5YR 4/6) mottles; weak fine and medium subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; about 20 percent gravel; neutral (pH 7.0); abrupt wavy boundary.

2C2—37 to 60 inches; multicolored very gravelly sand; single grain; loose; neutral (pH 7.2).

The depth to bedrock is more than 60 inches. The depth to a contrasting substratum is 20 to 40 inches.

The A horizon has value of 2 or 3 when moist and 4 or 5 when dry and has chroma of 2 or 3 when moist or dry. It is dominantly silt loam but has thin layers of loam or sandy loam in some pedons. It has 0 to 10 percent gravel.

The 2C horizon has value of 2 or 3 when moist and 4 or 5 when dry and has chroma of 1 to 3 when moist or dry. It is loamy sand or sand having 10 to 40 percent gravel.

Brannan Series

The Brannan series consists of deep, well drained soils on mountains. These soils formed in colluvium derived from schist and have volcanic ash in the surface horizon. Slope is 2 to 70 percent. Elevation is 4,000 to 6,000 feet. The average annual precipitation is 20 to 35 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 30 to 60 days.

Typical pedon of Brannan channery silt loam, 35 to 50 percent north slopes, about 0.5 mile west of Dooley Mountain summit, SW¼SE¼NE¼ sec. 25, T. 11 S., R. 39 E.

Oi—1 inch to 0; partially decomposed needles, twigs, and grasses.

A—0 to 4 inches; very dark grayish brown (10YR 3/2) channery silt loam, grayish brown (10YR 5/2) dry; weak fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine and fine roots; many very fine and fine irregular pores; about 30 percent channers; neutral (pH 7.0); clear wavy boundary.

Bw1—4 to 14 inches; dark yellowish brown (10YR 3/4) channery silt loam, yellowish brown (10YR 5/4) dry; weak fine subangular blocky structure parting to weak fine granular; soft, very friable, nonsticky and nonplastic; many very fine and fine and few medium roots; many very fine and fine tubular pores; about 30 percent channers; neutral (pH 7.0); abrupt wavy boundary.

2Bw2—14 to 28 inches; brown (10YR 4/3) very channery sandy clay loam, pale brown (10YR 6/3) dry; weak fine subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common fine and medium roots; common fine tubular pores; about 40 percent channers and 10 percent flagstones; neutral (pH 6.8); gradual wavy boundary.

2C—28 to 48 inches; brown (10YR 5/3) very channery sandy clay loam, pale (10YR 6/3) dry; massive; hard, friable, slightly sticky and slightly plastic; few fine and medium roots; common fine tubular pores; about 40 percent channers and 15 percent flagstones; neutral (pH 6.8); clear wavy boundary.

3R—48 inches; highly fractured schist with some soil material in cracks.

The depth to bedrock is 40 to 60 inches. The mantle of volcanic ash is 14 to 20 inches thick.

The A horizon has value of 2 or 3 when moist and 4 or 5 when dry and has chroma of 2 or 3 when moist or dry. It has 15 to 30 percent channers and 0 to 10 percent flagstones.

The Bw1 horizon has value of 3 or 4 when moist and 4 or 5 when dry and has chroma of 3 or 4 when moist or dry. It has 15 to 35 percent channers and 0 to 10 percent flagstones.

The 2Bw2 horizon has value of 4 or 5 when moist and 5 or 6 when dry and has chroma of 3 or 4 when moist or dry. It is sandy loam or sandy clay loam having 30 to 50 percent channers and 5 to 15 percent flagstones.

The 2C horizon has value of 5 or 6 when moist and 6 or 7 when dry and has chroma of 3 or 4 when moist or dry. It is sandy loam or sandy clay loam having 30 to 50 percent channers and 5 to 15 percent flagstones.

Brownlee Series

The Brownlee series consists of deep, well drained soils on hills. These soils formed in residuum derived from granodiorite and related granitic rocks. Slope is 2 to 35 percent. Elevation is 3,600 to 4,000 feet. The average annual precipitation is 16 to 20 inches, the average annual air temperature is 45 to 49 degrees F, and the average frost-free period is 110 to 130 days.

Typical pedon of Brownlee loam, in an area of Brownlee-Shangland loams, 2 to 12 percent slopes, about 2 miles southeast of Sparta, 25 feet north of road, 1,400 feet north and 200 feet west of the southeast corner of sec. 23, T. 8 S., R. 44 E.

A1—0 to 4 inches; very dark brown (10YR 2/2) loam, dark brown (10YR 4/3) dry; moderate fine subangular blocky structure parting to moderate fine granular; soft, friable, nonsticky and nonplastic; many very fine and common fine roots; common very fine and fine irregular pores; about 10 percent fine gravel; neutral (pH 6.6); clear smooth boundary.

A2—4 to 10 inches; very dark brown (10YR 2/2) loam, dark brown (10YR 3/3) dry; moderate fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; common very fine and fine tubular pores; about 5 percent gravel; neutral (pH 6.8); clear smooth boundary.

BA—10 to 17 inches; very dark grayish brown (10YR 3/2) clay loam, dark brown (10YR 4/4) dry; moderate fine and medium subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; common very fine and fine roots; common very fine and fine tubular pores; about 5 percent gravel; slightly acid (pH 6.4); clear smooth boundary.

Bt1—17 to 30 inches; dark brown (7.5YR 3/4) clay loam, dark brown (7.5YR 3/4) dry; moderate fine and medium angular blocky structure; hard, firm, sticky and plastic; common very fine and few fine roots; common very fine and fine tubular pores; many distinct clay films on faces of peds and bridges; about 5 percent gravel; slightly acid (pH 6.2); clear smooth boundary.

Bt2—30 to 36 inches; dark brown (7.5YR 3/4) sandy clay loam, brown (7.5YR 4/4) dry; weak fine and medium subangular blocky structure; hard, firm, slightly sticky and slightly plastic; few very fine and fine roots; common very fine tubular pores; common faint clay films on faces of peds; about 5 percent gravel; moderately acid (pH 6.0); clear smooth boundary.

C—36 to 42 inches; dark yellowish brown (10YR 3/4) sandy loam, yellowish brown (10YR 5/4) dry; weak fine subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common very fine tubular pores; about 10 percent fine gravel; moderately acid (pH 6.0); abrupt wavy boundary.

Cr—42 inches; partially weathered granodiorite grading to hard bedrock.

The depth to weathered bedrock is 40 to 60 inches.

The A horizon has value of 2 or 3 when moist and 3 or 4 when dry and has chroma of 2 or 3 when moist or dry. It has 5 to 15 percent gravel. Reaction is slightly acid or neutral.

The Bt horizon has value of 2 or 3 when moist and 3 or 4 when dry and has chroma of 3 or 4 when moist or dry. It is clay loam or sandy clay loam having 5 to 15 percent gravel and 27 to 35 percent clay. Reaction is moderately acid or slightly acid.

The C horizon is sandy clay loam or sandy loam. Reaction is moderately acid or slightly acid.

Brownscombe Series

The Brownscombe series consists of moderately deep, well drained soils on hills. These soils formed in residuum and colluvium derived from diorite and related granitic rocks and influenced by volcanic ash in the surface layer. Slope is 2 to 60 percent. Elevation is 2,400 to 3,400 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 110 to 130 days.

Typical pedon of Brownscombe silt loam, 2 to 12 percent slopes, 100 feet east and 700 feet south of the northwest corner of sec. 36, T. 8 S., R. 43 E.

Ap—0 to 5 inches; very dark grayish brown (10YR 3/2) silt loam, brown (10YR 5/3) dry; weak fine and medium subangular blocky structure parting to granular; soft, friable, slightly sticky and slightly plastic; many very fine and common fine roots; common very fine and fine tubular and irregular pores; slightly acid (pH 6.4); clear smooth boundary.

A—5 to 12 inches; dark brown (10YR 3/3) silt loam, brown (10YR 5/3) dry; weak fine and medium subangular blocky structure; soft, friable, slightly sticky and slightly plastic; common very fine roots; common very fine tubular and irregular pores; neutral (pH 7.0); clear smooth boundary.

2Bt1—12 to 18 inches; dark yellowish brown (10YR 3/4) sandy clay loam, dark yellowish brown (10YR 4/4) dry; weak medium subangular blocky structure; hard, firm, slightly sticky and slightly plastic; common very fine roots; common very fine tubular pores; many faint clay films on faces of peds; about 5 percent gravel; neutral (pH 7.2); clear smooth boundary.

2Bt2—18 to 25 inches; dark brown (7.5YR 4/4) sandy clay, brown (7.5YR 4/4) dry; moderate medium and coarse angular blocky structure; very hard, very firm, sticky and plastic; few very fine roots; few very fine tubular pores; continuous distinct clay films on faces of peds and lining pores; about 10 percent gravel; neutral (pH 7.2); clear wavy boundary.

2Cr—25 inches; partially weathered diorite.

The depth to weathered bedrock is 20 to 40 inches.

The A horizon has value of 2 or 3 when moist and 4 or 5 when dry and has chroma of 2 or 3 when moist or dry. It has 0 to 10 percent gravel. Reaction is slightly acid or neutral.

The 2Bt horizon has hue of 7.5YR or 10YR, value of 3 or 4 when moist and 4 or 5 when dry and has chroma of 3 or 4 when moist or dry. It is clay loam, sandy clay loam, or sandy clay having 0 to 10 percent gravel and 0 to 5 percent cobbles. Carbonates are below a depth of 30 inches in some pedons. Reaction is neutral to moderately alkaline.

Burkemont Series

The Burkemont series consists of deep, poorly drained soils on low terraces. These soils formed in mixed alluvium. Slope is 0 to 2 percent. Elevation is 3,300 to 3,400 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 110 to 140 days.

Typical pedon of Burkemont silty clay loam, 0 to 2 percent slopes, 4 miles east of Haines, adjacent to the Baldock Slough, NE¼SE¼NW¼ sec. 6, T. 8 S., R. 40 E.

Akn1—0 to 4 inches; dark grayish brown (2.5Y 4/2) silty clay loam, light brownish gray (2.5Y 6/2) dry; strong fine and medium angular blocky structure; hard, firm, slightly sticky and slightly plastic; many coarse and medium and common fine and very fine roots; many very fine and fine tubular pores; violently effervescent with disseminated lime; very strongly alkaline (pH 9.8); clear smooth boundary.

Akn2—4 to 11 inches; dark grayish brown (2.5Y 4/2) silty clay loam, light brownish gray (2.5Y 6/2) dry; strong medium and coarse angular blocky structure; hard, firm, slightly sticky and slightly plastic; few coarse and common fine and medium roots; many very fine and fine tubular pores; violently effervescent with disseminated lime; very strongly alkaline (pH 10.0); clear smooth boundary.

Akn3—11 to 16 inches; dark grayish brown (2.5Y 4/2) silty clay loam, light brownish gray (2.5Y 6/2) dry; common fine faint light olive brown (2.5Y 5/4) mottles; moderate medium subangular blocky structure; hard, firm, slightly sticky and slightly plastic; moderate fine and medium roots; many very fine and fine tubular pores; violently effervescent with disseminated lime; very strongly alkaline (pH 9.8); clear smooth boundary.

Bkn—16 to 25 inches; grayish brown (2.5Y 5/2) silty clay loam, light gray (2.5Y 7/2) dry; common fine faint light olive brown (2.5Y 5/4) mottles; massive; hard, firm, slightly sticky and slightly plastic; common fine roots; many fine tubular pores; violently effervescent with disseminated lime; very strongly alkaline (pH 9.3); abrupt smooth boundary.

2Bk1—25 to 46 inches; grayish brown (2.5Y 5/2) clay, light brownish gray (2.5Y 6/2) dry; many fine distinct light olive brown (2.5Y 5/6) mottles; massive; very hard, very firm, sticky and plastic; few fine roots; few fine tubular pores; strongly effervescent with disseminated lime; moderately alkaline (pH 8.4); gradual smooth boundary.

2Bk2—46 to 60 inches; light olive brown (2.5Y 5/4) silty clay loam, white (2.5Y 8/2) dry; common fine faint olive yellow (2.5Y 6/6) mottles; massive; hard, firm, slightly sticky and slightly plastic; few or common tubular pores; strongly effervescent, lime segregated in many medium irregularly shaped filaments or threads; strongly alkaline (pH 8.7).

The depth to bedrock is more than 60 inches. Depth to the 2Bk horizon is 20 to 40 inches.

The Akn horizon has hue of 2.5Y or 10YR, value of 4 or 5 when moist and 5 or 6 when dry, and chroma of 1 or 2 when moist or dry. The Akn3 horizon has common or many faint or distinct mottles.

The Bk horizon has hue of 2.5Y, value of 5 or 6 when moist and 6 to 8 when dry, and chroma of 2 to 4 when moist or dry. It has common or many faint or distinct mottles. It is silty clay loam, clay loam, silty clay, or clay having 35 to 60 percent clay. Reaction is moderate to very strongly alkaline. Lime is disseminated throughout the horizon or is segregated in irregularly shaped filaments and threads.

Burntriver Series

The Burntriver series consists of deep, well drained soils on low stream terraces and alluvial fans. These soils formed in mixed alluvium that is influenced by loess and volcanic ash in the surface layer. Slope is 0 to 12 percent. Elevation is 3,800 to 4,000 feet. The average annual precipitation is 9 to 12 inches, the average annual temperature is 40 to 45 degrees F, and the average frost-free period is 60 to 90 days.

Typical pedon of Burntriver silt loam, 0 to 2 percent slopes, 3,960 feet west of Higgins Reservoir in a cutbank along an intermittent drainageway, NE¼SW¼SE¼ sec. 1, T. 13 S., R. 37 E.

A1—0 to 3 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; weak thin platy and weak fine granular structure; soft, friable, nonsticky and nonplastic; many very fine and fine roots; many very fine and fine irregular pores; neutral (pH 7.2); clear smooth boundary.

A2—3 to 11 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; moderate very fine and fine subangular blocky structure; soft, friable, nonsticky and nonplastic; many very fine and fine roots; many very fine and fine tubular pores; mildly alkaline (pH 7.4); clear smooth boundary.
AB—11 to 26 inches; dark grayish brown (10YR 4/2) silty clay loam, light brownish gray (10YR 6/2) dry; moderate fine and medium subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; common very fine and fine roots; many very fine and fine continuous tubular pores; mildly alkaline (pH 7.6); gradual smooth boundary.
Bw1—26 to 39 inches; dark grayish brown (10YR 4/2) silty clay loam, pale brown (10YR 6/3) dry; strong medium angular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; common very fine and fine roots; many very fine and fine continuous tubular pores; mildly alkaline (pH 7.8); gradual smooth boundary.
Bw2—39 to 51 inches; dark grayish brown (10YR 4/2) silty clay loam, pale brown (10YR 6/3) dry; moderate medium and fine angular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; many very fine and fine continuous tubular pores; mildly alkaline (pH 7.8); gradual smooth boundary.
2Bw3—51 to 60 inches; dark grayish brown (10YR 4/2) gravelly sandy clay loam, light gray (10YR 7/2) dry; moderate medium and coarse subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; few fine roots; many fine discontinuous tubular pores; about 30 percent gravel; mildly alkaline (pH 7.8); clear wavy boundary.
2C—60 to 88 inches; yellowish brown (10YR 5/4) gravelly sandy clay loam, very pale brown (10YR 7/3) dry; moderate medium subangular blocky structure; slightly hard, friable slightly sticky and slightly plastic; many fine discontinuous tubular pores; about 30 percent gravel; mildly alkaline (pH 7.8).

The depth to bedrock is more than 60 inches.

The A horizon has value of 4 or 5 when moist and 6 or 7 when dry and has chroma of 2 or 3 when moist or dry. It is silt loam or gravelly silt loam having 0 to 20 percent gravel.

The Bw horizon has value of 4 or 5 when moist and 6 or 7 when dry and has chroma of 2 or 3 when moist or dry. It is silty clay loam or clay loam having 20 to 40 percent clay and 10 to 30 percent gravel.

The 2Bw3 and 2C horizons have value of 5 or 6 when moist and 6 or 7 when dry and have chroma of 3 or 4 when moist or dry. They are sandy clay loam or clay loam having 25 to 35 percent clay, 40 to 50 percent sand, and 20 to 30 percent gravel.

Campcreek Series

The Campcreek series consists of deep, well drained soils on side slopes of terraces. These soils formed in mixed alluvium. Slope is 12 to 60 percent. Elevation is 4,000 to 4,700 feet. The average annual precipitation is 12 to 16 inches, the average annual temperature is 40 to 45 degrees F, and the average frost-free period is 60 to 90 days.

Typical pedon of Campcreek very gravelly loam, in an area of Campcreek-Skullgulch association, 12 to 35 percent slopes, 1,800 feet west and 1,400 feet north of the southeast corner of sec. 28, T. 13 S., R. 37 E.

A1—0 to 2 inches; very dark grayish brown (10YR 3/2) very gravelly loam, grayish brown (10YR 5/2) dry; moderate fine granular structure; soft, friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine and fine irregular pores; about 45 percent gravel; neutral (pH 6.8); clear smooth boundary.
A2—2 to 8 inches; very dark grayish brown (10YR 3/2) very gravelly loam, grayish brown (10YR 5/2) dry; moderate fine and medium subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; many very fine and fine roots; many very fine and fine continuous tubular pores; about 40 percent gravel; neutral (pH 6.8); clear smooth boundary.
Bw—8 to 15 inches; very dark grayish brown (10YR 3/2) clay loam, grayish brown (10YR 5/2) dry; moderate medium and coarse subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; common very fine and fine roots; common very fine and fine tubular pores; about 10 percent gravel; neutral (pH 7.0); abrupt smooth boundary.
2Bt—15 to 27 inches; dark yellowish brown (10YR 4/4) clay, dark yellowish brown (10YR 4/4) dry; strong very coarse angular blocky structure; hard, very firm, very sticky and very plastic; few very fine roots; few very fine discontinuous tubular pores; many prominent clay films on faces of peds and lining pores; neutral (pH 7.2); clear smooth boundary.
2Btk1—27 to 51 inches; dark brown (7.5YR 4/4) clay, brown (7.5YR 4/4) dry; strong very coarse angular blocky structure; hard, very firm, very sticky and very plastic; many prominent clay films on faces of peds; strongly effervescent with segregated lime in

blotches; moderately alkaline (pH 8.0); clear smooth boundary.

2Btk2—51 to 65 inches; dark brown (7.5YR 4/4) silty clay, strong brown (7.5YR 5/6) dry; moderate medium subangular blocky structure; slightly hard, firm, sticky and plastic; few faint clay films on faces of peds; slightly effervescent; segregated lime in blotches; moderately alkaline (pH 8.0).

The depth to bedrock is more than 60 inches. Depth to the substratum is typically more than 60 inches but is 40 to 60 inches in some pedons. Depth to the 2Bt horizon is 10 to 20 inches. Hue is 10YR or 7.5YR.

The A horizon has value of 2 or 3 when moist and 4 or 5 when dry and has chroma of 2 or 3 when moist or dry. It has 35 to 45 percent gravel.

The Bw horizon has value of 2 or 3 when moist and 4 or 5 when dry and has chroma of 2 or 3 when moist or dry. It is loam, clay loam, or silty clay loam having 0 to 15 percent gravel.

The 2Bt horizon has value of 4 or 5 when moist or dry and has chroma of 3 or 4 when moist or dry. It is clay or silty clay having 50 to 60 percent clay.

The 2Btk horizon has value of 4 or 5 when moist and has chroma of 4 to 6 when moist or dry. It is clay or silty clay having 50 to 60 percent clay and 0 to 15 percent gravel. It is slightly effervescent to strongly effervescent.

Some pedons have a 2Ck horizon that has value of 4 or 5 when moist and 5 or 6 when dry and has chroma of 4 to 6 when moist or dry. It is clay loam or silty clay loam having 10 to 25 percent gravel. It is slightly effervescent to violently effervescent.

Catherine Series

The Catherine series consists of deep, somewhat poorly drained soils on flood plains. These soils formed in mixed alluvium. Slope is 0 to 2 percent. Elevation is 2,400 to 3,400 feet. The average annual precipitation is 18 to 22 inches, the average annual air temperature is 45 to 48 degrees F, and the average frost-free period is 110 to 130 days.

Typical pedon of Catherine silt loam, 0 to 2 percent slopes, about 0.25 mile east of the Halfway (Pine) Ranger District Office, in the southeast corner of NW¼NW¼ sec. 22, T. 8 S., R. 46 E.

Ap—0 to 8 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; moderate very fine and fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine irregular pores; neutral (pH 6.8); abrupt smooth boundary.

A1—8 to 16 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; moderate, medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine tubular pores; neutral (pH 6.8); clear smooth boundary.

A2—16 to 30 inches; very dark gray (10YR 3/1) silt loam, grayish brown (10YR 5/2) dry; common fine distinct dark yellowish brown (10YR 4/4) mottles; moderate, medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common very fine roots; many very fine tubular pores; neutral (pH 6.8); abrupt smooth boundary.

C1—30 to 48 inches; very dark grayish brown (10YR 3/2) silt loam, light brownish gray (10YR 6/2) dry; common fine distinct yellowish brown (10YR 5/4) mottles; massive; hard, firm, slightly sticky and slightly plastic; few fine roots; common very fine tubular pores; about 5 percent gravel; neutral (pH 7.0); clear smooth boundary.

2C2—48 to 60 inches; very dark grayish brown (10YR 3/2) fine sandy loam, grayish brown (10YR 5/2) dry; common fine faint yellowish brown (10YR 5/4) mottles; massive; hard, firm, slightly sticky and slightly plastic; about 10 percent gravel; neutral (pH 7.0).

The depth to bedrock is more than 60 inches.

The Ap and A horizons have value of 3 or 4 when dry and 1 or 2 when moist and have chroma of 2 or less when moist or dry. The depth to mottles is 12 to 24 inches. The A2 horizon is silt loam or silty clay loam.

The C horizon has value of 3 or 4 when moist and 5 or 6 when dry and has chroma of 2 or less when moist or dry. The C1 horizon is silt loam or silty clay loam. The 2C2 horizon is silt loam or fine sandy loam having 0 to 30 percent gravel.

Chambeam Series

The Chambeam series consists of deep, well drained soils on hills. These soils formed in colluvium derived from schist and graywacke. Slope is 12 to 50 percent. Elevation is 3,500 to 5,300 feet. The average annual precipitation is 12 to 16 inches, the average annual temperature is 40 to 45 degrees F, and the average frost-free period is 60 to 90 days.

Typical pedon of Chambeam very channery loam, in an area of Sinker and Chambeam soils, 35 to 50 percent north slopes, 1,300 feet north of the end of a road on Windy Ridge, NW¼NE¼SE¼ sec. 35, T. 11 S., R. 41 E.

A1—0 to 6 inches; very dark brown (10YR 2/2) very channery loam, dark grayish brown (10YR 4/2) dry; weak very fine subangular blocky structure; soft, very friable; nonsticky and nonplastic; many very fine and fine roots; many very fine and fine discontinuous tubular pores; about 50 percent channers; slightly acid (pH 6.4); clear smooth boundary.

A2—6 to 17 inches; very dark grayish brown (10YR 3/2) very channery loam, dark grayish brown (10YR 4/2) dry; moderate very fine and fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; many very fine and fine roots; many very fine and fine discontinuous tubular pores; about 50 percent channers; slightly acid (pH 6.4); clear smooth boundary.

Bw1—17 to 27 inches; dark brown (10YR 3/3) very channery loam, brown (10YR 5/3) dry; moderate fine subangular blocky structure; soft, friable, nonsticky and nonplastic; many very fine and fine roots; many very fine and fine discontinuous tubular pores; about 50 percent channers and 5 percent flagstones; neutral (pH 6.6); gradual smooth boundary.

Bw2—27 to 34 inches; dark brown (10YR 3/3) extremely channery loam, brown (10YR 5/3) dry; moderate fine and medium subangular blocky structure; soft, friable, nonsticky and nonplastic; common fine roots; many very fine and fine discontinuous tubular pores; about 60 percent channers and 5 percent flagstones; neutral (pH 6.6); clear smooth boundary.

C—34 to 45 inches; grayish brown (2.5YR 5/2) extremely channery loam, light brownish gray (2.5YR 6/2) dry; weak fine subangular blocky structure; soft, friable, nonsticky and nonplastic; few fine roots; many very fine and fine discontinuous tubular pores; about 60 percent channers and 15 percent flagstones; neutral (pH 6.8); gradual wavy boundary.

R—45 inches; highly fractured schist.

The depth to bedrock is 40 to 60 inches. The mollic epipedon is 20 to 40 inches thick.

The A horizon has value of 2 or 3 when moist and 4 or 5 when dry and has chroma of 1 to 3 when moist or dry. It has 40 to 50 percent channers and 0 to 10 percent flagstones.

The Bw horizon has value of 3 or 4 when moist and 5 or 6 when dry and has chroma of 2 to 4 when moist or dry. It is loam or clay loam having 20 to 30 percent clay, 40 to 70 percent channers, and 0 to 10 percent flagstones.

The C horizon has hue of 10YR or 2.5Y, value of 4 or 5 when moist and 5 to 7 when dry, and chroma of 2 to 4 when moist or dry. It is loam or clay loam having 20 to 30 percent clay, 40 to 70 percent channers, and 0 to 10 percent flagstones.

Clovercreek Series

The Clovercreek series consists of shallow, well drained soils on hills. These soils formed in colluvium derived from greenstone. Slope is 2 to 35 percent. Elevation is 3,000 to 3,800 feet. The average annual precipitation is 12 to 16 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 130 days.

Typical pedon of Clovercreek very gravelly loam, in an area of Clovercreek-Keating complex, 2 to 12 percent slopes, about 2 miles northeast of the Keating School, 2,300 feet south and 700 feet east of the northwest corner of sec. 3, T. 8 S., R. 42 E.

A1—0 to 3 inches; very dark brown (10YR 2/2) very gravelly loam, dark grayish brown (10YR 4/2) dry; moderate fine and medium granular structure; soft, friable, nonsticky and nonplastic; common very fine and fine roots; common very fine irregular pores; about 40 percent gravel; neutral (pH 6.8); clear smooth boundary.

A2—3 to 6 inches; very dark grayish brown (10YR 3/2) very gravelly loam, grayish brown (10YR 5/2) dry; moderate very fine and fine subangular blocky structure parting to moderate fine granular; soft, friable, nonsticky and nonplastic; common very fine and fine roots; common very fine irregular and tubular pores; about 40 percent gravel; neutral (pH 7.0); clear wavy boundary.

Bt1—6 to 10 inches; very dark grayish brown (10YR 3/2) very gravelly clay loam, grayish brown (10YR 5/2) dry; strong fine and medium subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; few very fine and fine roots; few very fine tubular pores; few faint clay films on faces of peds; about 40 percent gravel; neutral (pH 7.2); clear wavy boundary.

Bt2—10 to 16 inches; dark brown (10YR 4/3) very gravelly clay loam, brown (10YR 5/3) dry; strong fine and medium subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; few very fine roots; few very fine tubular pores; few faint clay films on faces of peds and lining pores; about 55 percent gravel; neutral (pH 7.2); abrupt wavy boundary.

R—16 inches; fractured greenstone.

The depth to bedrock is 14 to 20 inches.

The A horizon has value of 2 or 3 when moist and 4 or 5 when dry and has chroma of 2 or 3 when moist or dry. It has 20 to 50 percent gravel and 0 to 5 percent cobbles.

The Bt1 horizon has value of 2 or 3 when moist and 4 or 5 when dry and has chroma of 2 or 3 when moist or dry. The Bt2 horizon has value of 4 when moist and 5 or 6 when dry and has chroma of 3 or 4 when moist or dry. The Bt horizon is clay loam or silty clay loam having 35 to 60 percent gravel, 0 to 10 percent cobbles, and 27 to 35 percent clay.

Copperfield Series

The Copperfield series consists of deep, well drained soils on steep side slopes of low elevation hills and canyon walls. These soils formed in colluvium derived from basalt. Slope is 30 to 80 percent. Elevation is 2,000 to 3,400 feet. The average annual precipitation is 14 to 20 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 120 days.

Typical pedon of Copperfield very cobbly silt loam, in an area of Copperfield-Rock outcrop complex, 50 to 80 percent north slopes, 300 feet upstream of the Oxbow Dam Reservoir, NW¼SE¼NW¼ sec. 16, T. 7 S., R. 48 E.

A1—0 to 8 inches; black (10YR 2/1) very cobbly silt loam, dark grayish brown (10YR 4/2) dry; moderate very fine and fine subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; many fine and medium roots; many very fine and fine and common medium tubular pores; about 25 percent cobbles and 20 percent gravel; neutral (pH 6.6); clear smooth boundary.

A2—8 to 19 inches; very dark gray (10YR 3/1) very gravelly silt loam, dark grayish brown (10YR 4/2) dry; moderate fine subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; many fine and common medium roots; many very fine and fine and common medium tubular pores; about 40 percent gravel and 10 percent cobbles; neutral (pH 6.6); gradual smooth boundary.

Bw1—19 to 28 inches; very dark grayish brown (10YR 3/2) very gravelly silty clay loam, grayish brown (10YR 5/2) dry; moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many fine and few medium roots; many very fine and fine and common medium tubular pores; about 35 percent gravel and 15 percent cobbles; neutral (pH 6.8); clear smooth boundary.

Bw2—28 to 42 inches; dark brown (10YR 3/3) very cobbly silty clay loam, brown (10YR 5/3) dry; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine roots; many very fine and fine and few medium tubular pores; about 35 percent cobbles and 20 percent gravel; neutral (pH 6.8); gradual smooth boundary.

2Bt1—42 to 49 inches; dark grayish brown (10YR 4/2) extremely cobbly silty clay, pale brown (10YR 6/3) dry; moderate medium and coarse subangular blocky structure; hard, firm, sticky and plastic; few fine roots; many very fine and fine tubular pores; common distinct clay films on faces of peds and lining pores; about 50 percent cobbles and 15 percent gravel; neutral (pH 7.0); gradual wavy boundary.

2Bt2—49 to 60 inches; dark grayish brown (10YR 4/2) extremely cobbly clay, pale brown (10YR 6/3) dry; moderate medium and coarse subangular blocky structure; hard, firm, sticky and plastic; few fine roots; many very fine and fine tubular pores; many prominent clay films on faces of peds and lining pores; about 50 percent cobbles and 15 percent gravel; neutral (pH 7.0).

The depth to bedrock is typically more than 60 inches but is 40 to 60 inches in some pedons. The mollic epipedon is more than 40 inches thick. The subsoil is neutral or slightly acid. Depth to the 2Bt horizon is more than 40 inches.

The A horizon has value of 2 or 3 when moist and 3 or 4 when dry and has chroma of 1 or 2 when moist or dry. It has 20 to 40 percent gravel, 10 to 25 percent cobbles, and 0 to 10 percent stones.

The Bw horizon has value of 3 or 4 when moist and 4 or 5 when dry and has chroma of 2 or 3 when moist or dry. It is silty clay loam having 27 to 35 percent clay, 20 to 35 percent gravel, 15 to 40 percent cobbles, and 0 to 15 percent stones.

The 2Bt horizon has value of 4 or 5 when moist and 5 or 6 when dry and it has chroma of 2 or 3 when moist or dry. It is silty clay, clay, or silty clay loam having 35 to 50 percent clay, 10 to 20 percent gravel, 40 to 55 percent cobbles, and 0 to 5 percent stones.

Some pedons have a 2C horizon that has value of 5 or 6 when moist and 6 or 7 when dry and has chroma of 3 or 4 when moist or dry. It is loam or clay loam having 20 to 30 percent clay, 10 to 20 percent gravel, 40 to 55 percent cobbles, and 0 to 5 percent stones.

Crackler Series

The Crackler series consists of deep, well drained soils on mountains. These soils formed in colluvium derived from argillite and have a mantle of volcanic ash. Slope is 2 to 50 percent. Elevation is 3,800 to 6,200 feet. The average annual precipitation is 20 to 35 inches, the average annual air temperature is 40 to 45

degrees F, and the average frost-free period is 30 to 50 days.

Typical pedon of Crackler gravelly silt loam, in an area of Crackler-Rouen gravelly silt loams, 30 to 50 percent north slopes, 2,600 feet east and 1,700 feet south of the northwest corner of sec. 35, T. 8 S., R. 38 E.

Oi—1 inch to 0; partially decomposed fir needles, grass, and twigs.

A1—0 to 3 inches; dark brown (10YR 3/3) gravelly silt loam, brown (10YR 5/3) dry; weak very fine and fine subangular blocky structure parting to fine and medium granular; soft, very friable, nonsticky and nonplastic; moderately smeary; common very fine and fine roots; common very fine and fine irregular pores; about 25 percent gravel; slightly acid (pH 6.2); clear smooth boundary.

A2—3 to 9 inches; dark brown (10YR 3/3) gravelly silt loam, light yellowish brown (10YR 6/4) dry; weak fine and medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; moderately smeary; common fine and medium roots; common fine and medium irregular pores; about 20 percent gravel; slightly acid (pH 6.2); clear smooth boundary.

AB—9 to 17 inches; brown (10YR 4/3) gravelly silt loam, light yellowish brown (10YR 6/4) dry; moderate medium and coarse subangular blocky structure; soft, friable, nonsticky and nonplastic; weakly smeary; common fine and medium roots; common fine and medium irregular pores; about 30 percent gravel; slightly acid (pH 6.4); clear wavy boundary.

2Bw1—17 to 34 inches; brown (10YR 4/3) very cobbly silty clay loam, pale brown (10YR 6/3) dry; strong medium and coarse subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; common fine and medium roots; common fine and medium tubular pores; about 30 percent cobbles and 25 percent gravel; neutral (pH 6.6); clear smooth boundary.

2Bw2—34 to 45 inches; yellowish brown (10YR 5/4) extremely gravelly clay loam, very pale brown (10YR 7/4) dry; strong medium and coarse subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; few fine and medium roots; few fine and medium tubular pores; about 60 percent gravel and 2 percent cobbles; neutral (pH 6.8); clear smooth boundary.

2Bw3—45 to 54 inches; yellowish brown (10YR 5/4) extremely gravelly clay loam, very pale brown (10YR 7/4) dry; moderate medium subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; few fine roots; few fine tubular pores; about 65 percent gravel and 3 percent cobbles; neutral (pH 6.8); clear wavy boundary.

3R—54 inches; argillite.

The depth to bedrock is typically 40 to 60 inches but is more than 60 inches in some pedons. The thickness of the mantle of volcanic ash and depth to the 2Bw horizon are 14 to 25 inches. The surface has 10 to 30 percent gravel and 0 to 10 percent cobbles.

The A horizon has value of 2 or 3 when moist and 5 or 6 when dry and has chroma of 2 to 4 when moist or dry. It has 15 to 25 percent gravel and 0 to 5 percent cobbles.

The upper part of the Bw horizon has value of 3 to 5 when moist and 5 or 6 when dry and has chroma of 2 to 4 when moist and 3 or 4 when dry. It is silty clay loam or clay loam having 18 to 35 percent clay, 20 to 40 percent gravel, and 20 to 35 percent cobbles. The lower part has value of 4 or 5 when moist and 5 to 7 when dry and has chroma of 3 or 4 when moist or dry. It is silty clay loam or clay loam having 18 to 35 percent clay, 40 to 70 percent gravel, and 2 to 20 percent cobbles.

Cumulic Haploxerolls

These are deep, well drained and moderately well drained soils on flood plains. They formed in stratified, mixed alluvium. Slope is 0 to 2 percent. Elevation is 2,000 to 3,600 feet. The average annual precipitation is 9 to 20 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 140 days.

Typical pedon of Cumulic Haploxerolls, 0 to 2 percent slopes, about 150 feet north of fence, NE¼NW¼SE¼ sec. 15, T. 9 S., R. 45 E.

A1—0 to 3 inches; very dark brown (10YR 2/2) loam, grayish brown (10YR 5/2) dry; moderate fine subangular blocky structure parting to fine and medium granular; slightly hard, firm, nonsticky and nonplastic; many very fine and fine and few medium roots; few very fine and fine irregular pores; about 5 percent gravel; mildly alkaline (pH 7.6); clear smooth boundary.

A2—3 to 11 inches, very dark grayish brown (10YR 3/2) loam, brown (10YR 5/3) dry; strong medium subangular blocky structure; slightly hard, firm, nonsticky and nonplastic; common very fine roots; few very fine tubular pores, thin lamella of sand and loamy sand; mildly alkaline (pH 7.6); clear smooth boundary.

A3—11 to 25 inches; very dark grayish brown (10YR 3/2) sandy loam, brown (10YR 5/3) dry; moderate fine and medium subangular blocky structure; soft, friable, nonsticky and nonplastic; few very fine and fine roots; few very fine tubular pores; thin lamella of sand and loamy sand; neutral (pH 7.2); clear smooth boundary.

2C1—25 to 33 inches; dark brown (10YR 3/3) loamy sand, brown (10YR 5/3) dry; many fine and medium distinct strong brown (7.5YR 4/6) mottles; weak fine and medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; few very fine roots; few very fine tubular pores; neutral (pH 7.2); abrupt smooth boundary.

2C2—33 to 60 inches; multicolored extremely gravelly sand; single grain; loose; about 65 percent gravel; neutral (pH 7.0).

The depth to bedrock is more than 60 inches. Depth to the C horizon is 20 to 40 inches.

The A horizon has value of 2 or 3 when moist and 4 or 5 when dry and has chroma of 2 or 3 when moist or dry. In some pedons there are thin bands of sandy loam, loamy sand, and sand.

The 2C horizon has value of 2 or 3 when moist and 4 or 5 when dry and has chroma of 2 or 3 when moist or dry. It is loamy sand, sand, very gravelly sand, or extremely gravelly sand. It has 10 to 70 percent gravel and 0 to 30 percent cobbles.

Damore Series

The Damore series consists of deep, somewhat poorly drained soils on flood plains. These soils formed in mixed alluvium that is influenced by loess and volcanic ash in the surface layer. Slope is 0 to 3 percent. Elevation is 3,700 to 5,000 feet. The average annual precipitation is 12 to 25 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 50 to 90 days.

Typical pedon of Damore silt loam, in an area of Damore-Silvies silt loams, 0 to 3 percent slopes, SW¼NW¼SE¼ sec. 23, T. 13 S., R. 36 E.

A1—0 to 12 inches; very dark brown (10YR 2/2) silt loam, dark grayish brown (10YR 4/2) dry; moderate fine and medium subangular blocky structure parting to moderate fine and medium granular; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine and few medium roots; many very fine tubular pores; neutral (pH 7.2); clear smooth boundary.

A2—12 to 22 inches; very dark grayish brown (10YR 3/2) silty clay loam, grayish brown (10YR 5/2) dry; moderate fine and medium subangular blocky structure; slightly hard, friable, sticky and slightly plastic; common fine and few medium roots; many very fine tubular pores; neutral (pH 7.0); abrupt smooth boundary.

Bw—22 to 34 inches; dark yellowish brown (10YR 3/4) silty clay loam, brown (10YR 5/3) dry; common fine faint dark grayish brown (2.5Y 4/2) mottles; moderate medium and coarse subangular blocky structure; hard, firm, sticky and plastic; few fine and medium roots; many very fine tubular pores; neutral (pH 7.2); gradual smooth boundary.

2Bk1—34 to 40 inches; brown (10YR 5/3) silty clay, pale brown (10YR 6/3) dry; many medium prominent dark grayish brown (2.5Y 4/2) mottles; massive; hard, firm, sticky and plastic; common very fine tubular pores; violently effervescent; moderately alkaline (pH 8.2); clear smooth boundary.

2Bk2—40 to 52 inches; olive brown (2.5Y 4/4) silty clay, light yellowish brown (2.5Y 6/4) dry; massive; hard, firm, sticky and plastic; common very fine tubular pores; strongly effervescent; moderately alkaline (pH 8.0); gradual smooth boundary.

2C—52 to 60 inches; olive brown (2.5Y 4/4) gravelly clay, light yellowish brown (2.5Y 6/4) dry; massive; hard, firm, sticky and plastic; common very fine tubular pores; about 20 percent gravel and 5 percent cobbles; mildly alkaline (pH 7.8).

The depth to bedrock is more than 60 inches. Depth to the 2Bk horizon is 20 to 40 inches. The particle-size control section is silty clay loam to clay and has 35 to 60 percent clay. Rock fragments in the solum are 0 to 10 percent gravel.

The A1 horizon has value of 3 or 4 when dry and has chroma of 1 or 2 when moist or dry. The structure of this horizon is moderate granular or subangular blocky. The A2 horizon has value of 2 or 3 when moist and 4 or 5 when dry.

The Bw horizon has value of 3 or 4 when moist and 4 or 5 when dry and has chroma of 3 or 4 when moist or dry. It has few or common faint or distinct mottles. It is silty clay loam or silty clay having 35 to 45 percent clay.

The 2Bk horizon has value of 4 or 5 when moist and 5 or 6 when dry and has chroma of 3 or 4 when moist or dry. It has common or many distinct or prominent mottles and may be gleyed. It is silty clay or clay having 40 to 50 percent clay. Reaction is mildly alkaline or moderately alkaline.

The 2C horizon has hue of 2.5Y or 10YR. It has value of 4 or 5 when moist and 5 or 6 when dry and has chroma of 3 or 4 when moist or dry. It is silty clay or clay having 40 to 60 percent clay, 10 to 20 percent gravel, and 0 to 5 percent cobbles. In some pedons the upper part of this horizon is strongly effervescent or violently effervescent and has disseminated lime throughout.

Darkcanyon Series

The Darkcanyon series consists of moderately deep, well drained soils on hills. These soils formed in colluvium and residuum derived from schist and graywacke. Slope is 30 to 80 percent. Elevation is 2,000 to 4,000 feet. The average annual precipitation is 9 to 12 inches, the average annual temperature is 45 to 50 degrees F, and the average frost-free period is 110 to 130 days.

Typical pedon of Darkcanyon extremely channery loam, in an area of Rock outcrop-Xeric Torriorthents-Darkcanyon complex, 50 to 80 percent south slopes, 100 feet above the Burnt River Canyon Road, NE¼NE¼NE¼ sec. 31, T. 11 S., R. 42 E.

A1—0 to 7 inches, grayish brown (10YR 5/2) extremely channery loam, light gray (10YR 7/2) dry; weak very fine and fine subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; common fine and medium roots; many very fine and fine tubular pores; about 50 percent channers and 10 percent flagstones; neutral (pH 7.2); clear wavy boundary.

A2—7 to 13 inches; grayish brown (10YR 5/2) extremely channery clay loam, light brownish gray (10YR 6/2) dry; weak fine subangular blocky structure; hard, firm, slightly sticky and slightly plastic; common fine and medium roots; many fine and very fine tubular pores; about 60 percent channers and 5 percent flagstones; neutral (pH 7.2); gradual wavy boundary.

Bw1—13 to 23 inches; dark grayish brown (10YR 4/2) extremely channery clay loam, light brownish gray (10YR 6/2) dry; weak fine subangular blocky structure; hard, firm, slightly sticky and slightly plastic; common fine roots; many fine and very fine tubular pores; about 65 percent channers and 5 percent flagstones; neutral (pH 7.2); gradual wavy boundary.

Bw2—23 to 30 inches; dark grayish brown (10YR 4/2) extremely channery clay loam, light brownish gray (10YR 6/2) dry; weak fine subangular blocky structure; hard, firm, slightly sticky and slightly plastic; common fine roots; many fine and very fine tubular pores; about 70 percent channers; mildly alkaline (pH 7.4); gradual wavy boundary.

R—30 inches; highly fractured schist.

The depth to bedrock is 20 to 40 inches.

The A horizon has value of 6 or 7 when dry and 3 to 5 when moist and has chroma of 2 or 3 when moist or dry. It has 45 to 65 percent channers and 5 to 15 percent flagstones.

The Bw horizon has value of 6 or 7 when dry and 4 or 5 when moist and has chroma of 2 to 4 when moist or dry. It is loam or clay loam having 20 to 30 percent clay, 50 to 70 percent channers, and 0 to 10 percent flagstones.

Derringer Series

The Derringer series consists of moderately deep, well drained soils on mountain side slopes. These soils formed in colluvium derived from argillite, rhyolitic tuff, and breccia. Slope is 12 to 60 percent. Elevation is 4,000 to 5,700 feet. The average annual precipitation is 16 to 20 inches, the average annual temperature is 40 to 45 degrees F, and the average frost-free period is 50 to 90 days.

Typical pedon of Derringer very gravelly loam, in an area of Derringer-Harlow complex, 12 to 35 percent south slopes, NW¼NW¼NW¼ sec. 20, T. 11 S., R. 37 E.

A1—0 to 6 inches; very dark grayish brown (10YR 3/2) very gravelly loam, dark grayish brown (10YR 4/2) dry; weak very fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine and fine tubular pores; about 50 percent gravel and 5 percent cobbles; neutral (pH 6.8); clear smooth boundary.

A2—6 to 17 inches; dark brown (10YR 3/3) very gravelly clay loam, dark grayish brown (10YR 4/2) dry; moderate fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine and fine tubular pores; about 55 percent gravel; neutral (pH 6.8); gradual smooth boundary.

Bt1—17 to 26 inches; dark brown (10YR 4/3) extremely gravelly clay loam, brown (10YR 5/3) dry; moderate fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine roots; many fine tubular pores; few faint clay films on faces of peds; about 60 percent gravel; neutral (pH 6.6); gradual smooth boundary.

Bt2—26 to 36 inches; dark brown (10YR 4/3) extremely gravelly silty clay, brown (10YR 5/3) dry; strong fine and medium subangular blocky structure; hard, firm, sticky and plastic; common fine roots; few fine tubular pores; common distinct clay films on faces of peds and in pores; about 65 percent gravel; slightly acid (pH 6.4); abrupt wavy boundary.

2Cr—36 inches; highly weathered tuffaceous bedrock.

The depth to paralithic contact is 20 to 40 inches.

The mollic epipedon is 10 to 20 inches thick. Reaction is neutral or slightly acid throughout the solum.

The A horizon has value of 2 or 3 when moist and 3 or 4 when dry and has chroma of 2 or 3 when moist or dry. It has 30 to 50 percent gravel and 5 to 10 percent cobbles.

The Bt horizon has value of 4 or 5 when dry and has chroma of 2 or 3 when moist or dry. It is silty clay, clay, or clay loam having 35 to 50 percent clay, 40 to 65 percent gravel, and 0 to 20 percent cobbles.

Dogtown Series

The Dogtown series consists of deep, well drained soils on mountains. These soils formed in colluvium and residuum derived from quartz diorite and related granitic rocks and influenced by volcanic ash in the surface layer. Slope is 12 to 80 percent. Elevation is 3,800 to 6,200 feet. The average annual precipitation is 20 to 30 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 30 to 50 days.

Typical pedon of Dogtown gravelly loam, in an area of Dogtown complex, 35 to 55 percent north slopes, 700 feet east and 800 feet north of the southwest corner of sec. 3, T. 8 S., R. 38 E.

Oi—2 inches to 0; partially decomposed fir needles, grass, and moss.

A1—0 to 5 inches; very dark grayish brown (10YR 3/2) gravelly loam, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure; soft, friable, nonsticky and nonplastic; many very fine and fine and few medium roots; many very fine and fine tubular pores; about 25 percent gravel; neutral (pH 6.6); clear smooth boundary.

A2—5 to 11 inches; dark brown (10YR 3/3) gravelly loam, brown (10YR 5/3) dry; moderate fine and medium subangular blocky structure; soft, friable, nonsticky and nonplastic; many very fine and fine and few medium roots; many very fine and fine tubular pores; about 30 percent gravel; slightly acid (pH 6.4); clear smooth boundary.

Bw1—11 to 21 inches; dark brown (10YR 3/3) very gravelly sandy loam, pale brown (10YR 6/3) dry; moderate medium and coarse subangular blocky structure; slightly hard, firm, nonsticky and nonplastic; common very fine and fine roots; common very fine and fine tubular pores; about 35 percent gravel; slightly acid (pH 6.4); clear smooth boundary.

Bw2—21 to 28 inches; dark brown (10YR 3/3) very gravelly sandy loam, pale brown (10YR 6/3) dry; moderate medium subangular blocky structure parting to fine; slightly hard, firm, nonsticky and nonplastic; common very fine and fine roots; common very fine and fine tubular pores; about 45 percent gravel; slightly acid (pH 6.4); clear smooth boundary.

BC—28 to 41 inches; brown (10YR 4/3) very gravelly sandy loam, pale brown (10YR 6/3) dry; moderate fine and medium subangular blocky structure; slightly hard, firm, nonsticky and nonplastic; common very fine and fine roots; few very fine tubular pores; about 50 percent gravel; slightly acid (pH 6.2); clear smooth boundary.

C1—41 to 52 inches; brown (10YR 4/3) very gravelly loamy sand, pale brown (10YR 6/3) dry; massive; slightly hard, friable, nonsticky and nonplastic; few fine and medium roots; few fine tubular pores; about 50 percent gravel; slightly acid (pH 6.2); gradual smooth boundary.

C2—52 to 67 inches; brown (10YR 5/3) very gravelly loamy sand, very pale brown (10YR 7/3) dry; massive; slightly hard, friable, nonsticky and nonplastic; about 60 percent gravel; moderately acid (pH 6.0); gradual wavy boundary.

Cr—67 inches; highly weathered quartz diorite.

The depth to bedrock is typically more than 60 inches but is 40 to 60 inches in some pedons. The gravel is typically 2 to 5 millimeters in diameter.

The A horizon has value of 2 or 3 when moist and 4 or 5 when dry and has chroma of 1 to 3 when moist or dry. It is gravelly loam or very stony loam having 10 to 30 percent gravel, 0 to 15 percent cobbles, and 0 to 30 percent stones.

The Bw horizon has value of 3 or 4 when moist and has chroma of 2 or 3 when moist or dry. It has 30 to 50 percent gravel, 0 to 10 percent cobbles, and 0 to 40 percent stones.

The C horizon has value of 4 or 5 when moist and 6 or 7 when dry and has chroma of 3 or 4 when moist or dry. It is loamy sand having 30 to 60 percent gravel, 0 to 20 percent cobbles, and 0 to 40 percent stones.

Durkee Series

The Durkee series consists of moderately deep, well drained soils on hills. These soils formed in colluvium derived from argillite and influenced by volcanic ash and loess in the upper part. Slope is 2 to 60 percent. Elevation is 3,600 to 5,000 feet. The average annual precipitation is 12 to 16 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 50 to 110 days.

Typical pedon of Durkee gravelly silt loam, 2 to 12 percent slopes, about 0.25 mile south of the White Swan Mine, northwest corner of sec. 36, T. 9 S., R. 41 E.

A1—0 to 7 inches; very dark grayish brown (10YR 3/2) gravelly silt loam, grayish brown (10YR 5/2) dry; weak fine platy and weak very fine granular structure; soft, friable, slightly sticky and slightly plastic; many very fine and fine roots; common fine irregular pores; about 25 percent gravel; neutral (pH 7.0); clear smooth boundary.
2A2—7 to 10 inches; very dark grayish brown (10YR 3/2) clay loam, grayish brown (10YR 5/2) dry; moderate fine subangular blocky structure; hard, friable, sticky and plastic; many very fine and fine roots; many very fine tubular pores; neutral (pH 7.0); gradual smooth boundary.
2Bt1—10 to 14 inches; dark brown (10YR 3/3) clay, brown (10YR 4/3) dry; weak fine prismatic structure parting to moderate fine subangular blocky; very hard, friable, very sticky and very plastic; common fine roots; common very fine and fine tubular pores; continuous prominent clay films on faces of peds and in pores; neutral (pH 7.2); gradual smooth boundary.
2Bt2—14 to 17 inches; dark yellowish brown (10YR 4/4) clay, dark brown (10YR 3/3) dry; moderate fine prismatic structure parting to strong subangular blocky; very hard, friable, very sticky and very plastic; common fine and very fine tubular pores; continuous prominent clay films on faces of peds and in pores; neutral (pH 7.2); clear smooth boundary.
3Bk—17 to 22 inches; brown (10YR 5/3) silty clay loam, pale brown (10YR 6/3) dry; massive; hard, friable, sticky and plastic; common fine and very fine tubular pores; strongly effervescent; moderately alkaline (pH 8.4); abrupt wavy boundary.
3R—22 inches; lime-coated argillite.

The depth to bedrock is 20 to 40 inches. The depth to lime is 15 to 30 inches.

The A horizon has value of 2 or 3 when moist and 4 or 5 when dry and has chroma of 2 or 3 when moist or dry. It has 15 to 25 percent gravel and 0 to 15 percent cobbles.

The 2Bt horizon has value of 3 to 5 when moist and 3 to 6 when dry and has chroma of 3 and 4 when moist or dry. It is clay or silty clay having 40 to 60 percent clay and 0 to 15 percent gravel. The structure is weak or moderate prismatic parting to moderate or strong subangular or angular blocky. In some pedons the lower part of this horizon is calcareous.

The 3Bk horizon has value of 4 or 5 when moist and 6 or 7 when dry and has chroma of 3 or 4 when moist and 2 or 3 when dry. It is silty clay loam or clay loam having 0 to 20 percent gravel and 0 to 5 percent cobbles.

Eaglecap Series

The Eaglecap series consists of deep, well drained soils on mountains. These soils formed in colluvium and residuum derived from quartz diorite and related granitic rocks and influenced by volcanic ash in the surface layer. Slope is 30 to 80 percent. Elevation is 6,200 to 8,500 feet. The average annual precipitation is 30 to 40 inches, the average annual air temperature is 35 to 40 degrees F, and the average frost-free period is 20 to 40 days.

Typical pedon of Eaglecap very stony loam, 30 to 80 percent north slopes, 1,300 feet north and 500 feet east of the southwest corner of sec. 10, T. 7 S., R. 37 E.

Oi—1 inch to 0; partially decomposed fir needles, grass, and moss.
A1—0 to 3 inches; very dark brown (10YR 2/2) very stony loam, dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure parting to granular; soft, very friable, nonsticky and nonplastic; weakly smeary; many very fine and fine roots; many very fine and fine continuous irregular pores; about 30 percent stones and 15 percent gravel; neutral (pH 6.6); clear smooth boundary.
A2—3 to 16 inches; dark brown (10YR 3/3) very stony loam, pale brown (10YR 6/3) dry; weak fine and medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; weakly smeary; many very fine and fine and few medium roots; many very fine and fine continuous tubular pores; about 10 percent stones, 20 percent cobbles, and 20 percent gravel; slightly acid (pH 6.4); abrupt wavy boundary.
2Bw—16 to 28 inches; brown (10YR 5/3) very cobbly sandy loam, pale brown (10YR 6/3) dry; moderate fine and medium subangular blocky structure; slightly hard, firm, nonsticky and nonplastic; common very fine and fine and few medium roots; common very fine and fine continuous tubular pores; about 30 percent gravel, 20 percent cobbles, and 5 percent stones; slightly acid (pH 6.4); clear smooth boundary.
2C1—28 to 37 inches; brown (10YR 5/3) extremely cobbly loamy sand, light yellowish brown (10YR 6/4) dry; massive; slightly hard, friable, nonsticky and nonplastic; few very fine and fine roots; few very fine and fine continuous tubular pores; about 30 percent cobbles, 30 percent gravel, and 5 percent stones; slightly acid (pH 6.2); gradual smooth boundary.
2C2—37 to 60 inches; yellowish brown (10YR 5/4) extremely cobbly loamy sand, very pale brown (10YR 7/3) dry; massive; slightly hard, friable,

nonsticky and nonplastic; few very fine roots; few very fine discontinuous tubular pores; about 50 percent cobbles, 20 percent gravel, and 5 percent stones; slightly acid (pH 6.2).

The depth to bedrock is typically more than 60 inches but is 40 to 60 inches in some pedons. Depth to the 2Bw horizon is 15 to 25 inches.

The A1 horizon has value of 4 or 5 when dry and 2 or 3 when moist. The A2 horizon has moist value of 3 or 4. The A horizon has 10 to 30 percent gravel, 0 to 20 percent cobbles, and 20 to 30 percent stones. It is weakly smeary or moderately smeary.

The 2Bw horizon has value of 4 or 5 when moist and 6 or 7 when dry and has chroma of 3 or 4 when moist or dry. It has 15 to 30 percent gravel, 10 to 20 percent cobbles, and 0 to 20 percent stones.

The 2C horizon has value of 4 or 5 when moist and 6 or 7 when dry and has chroma of 3 or 4 when moist or dry. It has 10 to 30 percent gravel, 20 to 50 percent cobbles, and 0 to 10 percent stones.

Emily Series

The Emily series consists of deep, well drained soils on foot slopes and mountain side slopes. These soils formed in colluvium derived from basalt and influenced by loess and volcanic ash in the surface layer. Slope is 12 to 60 percent. Elevation is 2,000 to 3,300 feet. The average annual precipitation is 20 to 24 inches, the average annual air temperature is 45 to 49 degrees F, and the average frost-free period is 100 to 120 days.

Typical pedon of Emily silt loam, 35 to 60 percent north slopes, at the northwest corner of sec. 34, T. 7 S., R. 47 E.

Oi—3 inches to 0; partially decomposed needles, leaves, and twigs.

A1—0 to 3 inches; very dark brown (10YR 2/2) silt loam, dark grayish brown (10YR 4/2) dry; moderate fine and medium granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine and fine and common medium roots; common very fine and fine tubular pores; about 10 percent gravel; slightly acid (pH 6.4); clear wavy boundary.

A2—3 to 8 inches; very dark grayish brown (10YR 3/2) silt loam, dark brown (10YR 4/3) dry; moderate fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; common fine and medium roots; common very fine and fine tubular pores; about 10 percent gravel; neutral (pH 6.6); clear wavy boundary.

Bw1—8 to 16 inches; dark brown (10YR 3/3) very cobbly silty clay loam, brown (10YR 4/3) dry; moderate medium and fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and medium roots; common fine tubular pores; about 25 percent cobbles and 10 percent gravel; neutral (pH 6.7); clear wavy boundary.

Bw2—16 to 29 inches; dark brown (10YR 3/3) very cobbly silty clay loam, brown (10YR 4/3) dry; moderate medium and coarse subangular blocky structure; slightly hard, friable, sticky and plastic; common medium and few coarse roots; common fine tubular pores; about 40 percent cobbles and 10 percent gravel; neutral (pH 6.8); clear wavy boundary.

Bw3—29 to 42 inches; dark yellowish brown (10YR 3/4) very cobbly clay loam, dark yellowish brown (10YR 4/4) dry; moderate medium and coarse subangular blocky structure; hard, friable, sticky and plastic; common medium and few coarse roots; common fine tubular pores; about 25 percent cobbles, 15 percent gravel, and 10 percent stones; neutral (pH 6.8); clear wavy boundary.

Bw4—42 to 60 inches; dark yellowish brown (10YR 4/4) very cobbly clay loam, yellowish brown (10YR 5/4) dry; moderate medium and coarse subangular blocky structure; hard, firm, sticky and plastic; few medium and coarse roots; few fine tubular pores; about 35 percent cobbles, 15 percent stones, and 15 percent gravel; neutral (pH 6.8).

The thickness of the solum and the depth to bedrock are mainly 40 to 60 inches. Hue is 7.5YR or 10YR.

The A horizon has value of 2 or 3 when moist and 4 or 5 when dry and has chroma of 2 or 3 when moist or dry. It has 0 to 10 percent gravel and 0 to 5 percent stones or cobbles.

The Bw horizon has value of 3 or 4 when moist and 4 or 5 when dry and has chroma of 2 to 4 when moist or dry. It is loam, clay loam, or silty clay loam having 25 to 35 percent clay, 25 to 50 percent cobbles and stones, and 10 to 20 percent gravel.

Encina Series

The Encina series consists of deep, well drained soils on terraces. These soils formed in mixed lacustrine sediments influenced by volcanic ash. Slope is 2 to 50 percent. Elevation is 2,800 to 3,800 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 110 to 130 days.

Typical pedon of Encina gravelly silt loam, 12 to 35 percent south slopes, in SW¼NW¼ sec. 18, T. 10 S., R. 41 E.

A1—0 to 4 inches; very dark grayish brown (10YR 3/2) gravelly silt loam, grayish brown (10YR 5/2) dry; moderate very fine granular structure; soft, friable, slightly sticky and slightly plastic; many very fine roots; common fine vesicular pores; about 20 percent gravel; neutral (pH 6.9); clear smooth boundary.

2A2—4 to 7 inches; dark brown (10YR 3/3) clay loam, brown (10YR 5/3) dry; weak very fine granular structure; slightly hard, firm, sticky and plastic; common very fine roots; common very fine and fine tubular pores; neutral (pH 7.0); clear smooth boundary.

2Bt—7 to 12 inches; dark brown (10YR 3/3) clay, brown (10YR 5/3) dry; moderate medium subangular blocky structure; very hard, firm, very sticky and very plastic; common very fine roots; few fine tubular pores; continuous faint clay films on faces of peds; mildly alkaline (pH 7.6); clear smooth boundary.

2Bk1—12 to 18 inches; dark yellowish brown (10YR 4/4) silty clay loam, pale brown (10YR 6/3) dry; massive; hard, friable, sticky and plastic; few very fine roots; few very fine pores; slightly effervescent; splotches of soft powdery lime and mycelia; moderately alkaline (pH 8.1); clear smooth boundary.

2Bk2—18 to 42 inches; grayish brown (10YR 5/2) silt loam, light gray (10YR 7/2) dry; massive; soft, friable, slightly sticky and slightly plastic; few very fine roots; few very fine pores; strongly effervescent with segregated and disseminated lime; moderately alkaline (pH 8.4); abrupt smooth boundary.

3C—42 to 60 inches; multicolored extremely gravelly loam; massive; hard, firm, slightly sticky and slightly plastic; weakly cemented; about 85 percent gravel.

The depth to bedrock is more than 60 inches. Depth to the extremely gravelly 3C horizon is 40 to 60 inches.

The A horizon has value of 3 or 4 when moist and 4 or 5 when dry and has chroma of 1 to 3 when moist or dry. It has 15 to 30 percent gravel.

The 2Bt horizon has value of 3 or 4 when moist and 4 or 5 when dry and has chroma of 2 to 4 when moist or dry. It is clay loam, clay, or silty clay having 0 to 15 percent gravel.

The 2Bk horizon has hue of 10YR or 2.5Y, value of 4 to 7 when moist and 6 to 8 when dry, and chroma of 2 to 4 when moist or dry. It is loam, silt loam, silty clay loam, or clay loam having 5 to 15 percent gravel.

The 3C horizon is loam having 35 to 85 percent gravel.

Fivebit Series

The Fivebit series consists of shallow, well drained soils on side slopes of mountains. These soils formed in colluvium derived from andesite and basalt. Slope is 12 to 60 percent. Elevation is 4,400 to 6,000 feet. The average annual precipitation is 16 to 30 inches, the average annual temperature is 40 to 45 degrees F, and the average frost-free period is 50 to 90 days.

Typical pedon of Fivebit extremely stony loam, in an area of Klicker-Fivebit complex, 12 to 35 percent south slopes, SE1/4NW1/4SE1/4 sec. 16, T. 13 S., R. 36 E.

Oi—1/2 inch to 0; partially decomposed needles, leaves, and twigs.

A1—0 to 3 inches; very dark grayish brown (10YR 3/2) extremely stony loam, grayish brown (10YR 5/2) dry; weak very fine granular structure; soft, friable, nonsticky and nonplastic; many very fine and fine and few medium roots; many fine and very fine irregular pores; about 30 percent stones, 20 percent gravel, and 15 percent cobbles; neutral (pH 7.0); clear smooth boundary.

A2—3 to 12 inches; very dark grayish brown (10YR 3/2) very gravelly loam, grayish brown (10YR 5/2) dry; moderate very fine and fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine and few medium roots; many fine and very fine tubular pores; about 40 percent gravel and 15 percent cobbles; neutral (pH 6.8); clear smooth boundary.

Bw—12 to 18 inches; dark brown (10YR 3/3) extremely gravelly clay loam, brown (10YR 5/3) dry; moderate fine subangular blocky structure; hard, firm, slightly sticky and slightly plastic; few very fine and fine roots; many fine and very fine tubular pores; about 45 percent gravel and 20 percent cobbles; neutral (pH 6.6); abrupt wavy boundary.

R—18 inches; highly fractured andesite.

The depth to bedrock is 10 to 20 inches. Reaction is slightly acid or neutral throughout the solum. Hue is 10YR or 7.5YR.

The A1 horizon has value of 2 or 3 when moist and 4 or 5 when dry and has chroma of 2 or 3 when moist or dry. It has 20 to 30 percent stones, 10 to 20 percent cobbles, and 10 to 30 percent gravel.

The A2 horizon has colors similar to those of the A1 horizon. It is loam, silty clay loam, or clay loam having 35 to 45 percent gravel, 10 to 20 percent cobbles, and 0 to 5 percent stones.

The Bw horizon has value of 3 or 4 when moist and 4 or 5 when dry and has chroma of 2 to 4 when moist or dry. It is clay loam, silty clay loam, or loam having 25 to 35 percent clay, 30 to 50 percent gravel, 10 to 20 percent cobbles, and 0 to 5 percent stones.

Glasgow Series

The Glasgow series consists of moderately deep, well drained soils on hills. These soils formed in colluvium derived from volcanic tuff and influenced by volcanic ash and loess in the surface layer. Slope is 2 to 7 percent. Elevation is 2,400 to 3,400 feet. The average annual precipitation is 10 to 12 inches, the average annual air temperature is 47 to 50 degrees F, and the average frost-free period is 90 to 130 days.

Typical pedon of Glasgow silt loam, 2 to 7 percent slopes, 150 feet southeast of Sparta Road, 100 feet northeast of field boundary, NE¼NW¼NW¼ sec. 26, T. 8 S., R. 43 E.

Ap—0 to 6 inches; very dark grayish brown (10YR 3/2) silt loam, light brownish gray (10YR 6/2) dry; weak thin and medium platy structure parting to moderate fine granular; soft, friable, slightly sticky and slightly plastic; many very fine and fine roots; many medium vesicular and very fine tubular pores; neutral (pH 6.6); clear smooth boundary.

A—6 to 12 inches; dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak coarse prismatic structure parting to moderate medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; common very fine tubular pores; neutral (pH 6.7); clear wavy boundary.

2Bt—12 to 16 inches; dark brown (10YR 3/3) clay, brown (10YR 5/3) dry; strong medium prismatic structure parting to moderate fine and medium subangular blocky; hard, firm, very sticky and very plastic; few fine roots; common fine tubular pores; continuous faint clay films on faces of peds and in pores; neutral (pH 7.3); clear wavy boundary.

2Btk—16 to 24 inches; dark yellowish brown (10YR 4/4) clay loam, light yellowish brown (10YR 6/4) dry; moderate medium subangular blocky structure; hard, firm, sticky and plastic; few fine roots; common fine tubular pores; continuous prominent clay films on faces of peds and in pores; few chips of volcanic tuff; strongly effervescent; calcium carbonate in blotches and mycelia streaks; moderately alkaline (pH 8.3); abrupt wavy boundary.

3R—24 inches; fractured volcanic tuff.

The depth to bedrock is 20 to 40 inches.

The Ap and A horizons have value of 3 or 4 when moist and 5 or 6 when dry and have chroma of 2 or 3 when moist or dry.

The 2Bt horizon has value of 3 or 4 when moist and 5 or 6 when dry and has chroma of 3 or 4 when moist or dry. It is clay or clay loam having 35 to 55 percent clay. The structure is moderate or strong prismatic parting to weak or moderate subangular blocky.

The 2Btk horizon has value of 6 or 7 when dry and has chroma of 3 or 4 when moist or dry. It is clay loam or clay having 35 to 45 percent clay. It is weakly effervescent to strongly effervescent.

Goodrich Series

The Goodrich series consists of deep, well drained soils on alluvial fans. These soils formed in mixed alluvium. Slope is 0 to 7 percent. Elevation is 3,400 to 3,800 feet. The average annual precipitation is 12 to 16 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 130 days.

Typical pedon of Goodrich gravelly loam, 0 to 7 percent slopes, about 1,400 feet north and 360 feet east of the southwest corner of sec. 28, T. 8 S., R. 39 E.

Ap—0 to 6 inches; very dark grayish brown (10YR 3/2) gravelly loam, grayish brown (10YR 5/2) dry; weak fine granular structure; soft, friable, slightly sticky and slightly plastic; many very fine roots; many very fine and fine irregular pores; about 15 percent gravel; neutral (pH 7.3); abrupt smooth boundary.

A—6 to 12 inches; very dark grayish brown (10YR 3/2) gravelly loam, grayish brown (10YR 5/2) dry; weak medium and coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and very fine roots; many very fine tubular pores; about 20 percent gravel; mildly alkaline (pH 7.6); clear smooth boundary.

C1—12 to 25 inches; dark brown (10YR 4/3) gravelly loam, dark grayish brown (10YR 5/2) dry; massive; slightly hard, friable, slightly sticky and slightly plastic; common fine roots; common very fine tubular pores; about 25 percent gravel; mildly alkaline (pH 7.6); abrupt smooth boundary.

C2—25 to 40 inches; dark brown (10YR 4/3) gravelly loam, grayish brown (10YR 5/2) dry; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; common very fine tubular pores; about 30 percent gravel; mildly alkaline (pH 7.5); gradual wavy boundary.

2C3—40 to 60 inches; dark brown (10YR 4/3) and dark grayish brown (10YR 4/2) stratified very gravelly loam and very gravelly sandy loam, light brownish gray (10YR 6/2) dry; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine tubular pores; about 45 percent gravel; mildly alkaline (pH 7.5).

The depth to bedrock is more than 60 inches. The mollic epipedon is 10 to 20 inches thick.

The A horizon has value of 2 or 3 when moist and 4 or 5 when dry and has chroma of 1 or 2 when moist or dry. It has 15 to 25 percent gravel.

The C horizon has value of 4 or 5 when dry and has chroma of 2 or 3 when moist or dry. It has 15 to 35 percent gravel and 0 to 10 percent cobbles.

The 2C horizon has value of 4 or 5 when moist or dry and has chroma of 2 or 3 when moist or dry. It has 35 to 50 percent gravel.

Greenscombe Series

The Greenscombe series consists of moderately deep, well drained soils on hills. These soils formed in colluvium derived from quartz diorite and related granitic rocks. Slope is 2 to 35 percent. Elevation is 3,200 to 3,800 feet. The average annual precipitation is 12 to 16 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 130 days.

Typical pedon of Greenscombe loam, 2 to 12 percent slopes, about 4 miles east of North Powder, SE¼SW¼ sec. 32, T. 6 S., R. 40 E.

A1—0 to 6 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; moderate fine and medium subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; common fine and few medium roots; common very fine tubular and irregular pores; mildly alkaline (pH 7.4); gradual wavy boundary.

A2—6 to 11 inches; dark brown (10YR 3/3) loam, grayish brown (10YR 5/2) dry; moderate fine and medium subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; few fine and medium roots; common very fine and fine tubular pores; mildly alkaline (pH 7.6); clear wavy boundary.

2Bw—11 to 19 inches; dark yellowish brown (10YR 3/4) sandy clay loam, brown (10YR 5/3) dry; moderate medium and coarse subangular blocky structure; slightly hard, friable, sticky and plastic; few fine and medium roots; common fine tubular pores; about 10 percent gravel; mildly alkaline (pH 7.8); gradual wavy boundary.

2C1—19 to 26 inches; dark yellowish brown (10YR 3/6) sandy clay loam, yellowish brown (10YR 5/4) dry; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few medium roots; common fine tubular pores; about 10 percent gravel; mildly alkaline (pH 7.8); gradual wavy boundary.

2C2—26 to 30 inches; dark yellowish brown (10YR 3/6) gravelly sandy loam, yellowish brown (10YR 5/6) dry; massive; loose, nonsticky and nonplastic; common fine tubular pores; about 30 percent gravel; mildly alkaline (pH 7.6); clear wavy boundary.

3Cr—30 inches; weathered quartz diorite.

The depth to weathered bedrock is 20 to 40 inches. Reaction is neutral or mildly alkaline in the solum and substratum.

The A horizon has value of 2 or 3 when moist and 4 or 5 when dry and has chroma of 2 or 3 when moist or dry. It has 0 to 10 percent gravel.

The 2Bw horizon has value of 3 or 4 when moist and 4 to 6 when dry and has chroma of 3 or 4 when moist or dry. It is sandy clay loam, clay loam, or loam having 5 to 15 percent gravel.

The 2C horizon has value of 3 or 4 when moist and 5 or 6 when dry and has chroma of 3 to 6 when moist or dry. It is sandy loam or sandy clay loam having 5 to 35 percent gravel.

Gwinly Series

The Gwinly series consists of shallow, well drained soils on ridgetops and side slopes of hills. These soils formed in colluvium derived from basalt and influenced by loess and volcanic ash in the surface layer. Slope is 2 to 70 percent. Elevation is 2,000 to 4,000 feet. The average annual precipitation is 14 to 20 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 120 days.

Typical pedon of Gwinly very cobbly silt loam, in an area of Robinette-Gwinly complex, 2 to 12 percent slopes, 200 feet north and 800 feet east of the southwest corner of sec. 28, T. 8 S., R. 47 E.

A—0 to 3 inches; very dark brown (10YR 2/2) very cobbly silt loam, brown (10YR 5/3) dry; moderate very fine and fine subangular blocky structure parting to moderate fine and medium granular; soft, very friable, nonsticky and nonplastic; common very fine and fine roots; common very fine and fine irregular pores; about 20 percent gravel, 25 percent cobbles, and 5 percent stones; neutral (pH 7.0); clear smooth boundary.

BA—3 to 8 inches; very dark brown (10YR 2/2) very cobbly silty clay loam, brown (10YR 5/3) dry; moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; common very fine and fine tubular pores; about 20 percent gravel and 35 percent cobbles; neutral (pH 7.0); clear smooth boundary.

Bt—8 to 17 inches; dark brown (7.5YR 3/4) extremely cobbly clay, brown (7.5YR 4/4) dry; moderate fine and medium subangular blocky structure; hard, firm, sticky and plastic; few very fine roots; few very fine tubular pores; many prominent clay films on faces of peds and lining pores; about 20 percent gravel and 55 percent cobbles; neutral (pH 7.2); abrupt wavy boundary.

2R—17 inches; fractured basalt.

The depth to bedrock is 10 to 20 inches. Hue is 10YR or 7.5YR.

The A and BA horizons have value of 2 or 3 when moist and 4 or 5 when dry and have chroma of 2 or 3 when moist or dry. They have 10 to 25 percent gravel, 20 to 40 percent cobbles, and 0 to 10 percent stones.

The Bt horizon has value of 2 or 3 when moist and 4 or 5 when dry and has chroma of 2 to 4 when moist or dry. It has 10 to 20 percent gravel, 40 to 55 percent cobbles, and 0 to 10 percent stones.

Haines Series

The Haines series consists of deep, poorly drained soils on flood plains. These soils formed in mixed alluvium that is influenced by loess and volcanic ash in the surface layer. Slope is 0 to 2 percent. Elevation is 2,000 to 3,400 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 110 to 140 days.

Typical pedon of Haines silt loam, 0 to 2 percent slopes, about 4 miles southeast of Haines, SW¼SW¼SE¼ sec. 12, T. 8 S., R. 39 E.

Akn—0 to 3 inches; dark grayish brown (2.5Y 4/2) silt loam, light brownish gray (2.5Y 6/2) dry; weak medium platy structure; very hard, firm, slightly sticky and slightly plastic; many coarse and medium and common fine and very fine roots; many very fine and fine tubular pores; violently effervescent; very strongly alkaline (pH 9.6); clear smooth boundary.

Ak—3 to 9 inches; dark grayish brown (2.5Y 4/2) silt loam, light brownish gray (2.5Y 6/2) dry; moderate fine subangular blocky structure; hard, firm, slightly sticky and slightly plastic; few coarse and common fine and medium roots; many very fine and fine tubular pores; violently effervescent; strongly alkaline (pH 8.6); clear smooth boundary.

Bk1—9 to 21 inches; dark grayish brown (2.5Y 4/2) silt loam, light gray (2.5Y 7/2) dry; common fine distinct light olive brown (2.5Y 5/4) mottles; massive; hard, firm, brittle, slightly sticky and slightly plastic; few coarse and common fine and medium roots; many very fine tubular pores; violently effervescent; moderately alkaline (pH 8.4); gradual smooth boundary.

Bk2—21 to 30 inches; dark grayish brown (2.5Y 4/2) silt loam, light brownish gray (2.5Y 6/2) dry; common fine distinct light olive brown (2.5Y 5/4) mottles; massive; hard, firm, slightly sticky and slightly plastic; common fine and medium roots; common fine and very fine tubular pores; strongly effervescent; moderately alkaline (pH 8.2); gradual smooth boundary.

2C—30 to 43 inches; grayish brown (2.5Y 5/2) silt loam, white (2.5Y 8/2) dry; massive; hard, firm, slightly sticky and slightly plastic; few fine and medium roots; common very fine tubular pores; moderately alkaline (pH 8.2); gradual smooth boundary.

3C—43 to 60 inches; grayish brown (2.5Y 5/2) sandy clay loam, light gray (2.5Y 7/2) dry; many large prominent light olive brown (2.5Y 5/4) and olive brown (2.5Y 4/4) mottles; massive; hard, firm, slightly sticky and slightly plastic; common very fine tubular pores; moderately alkaline (pH 7.8).

The depth to bedrock is more than 60 inches. Depth to the 2C horizon is 20 to 40 inches. The content of gravel is 0 to 10 percent throughout the profile.

The Akn and Ak horizons have hue of 2.5Y or 10YR, value of 3 or 4 when moist and 5 or 6 when dry, and chroma of 1 or 2 when moist or dry. Reaction is very strongly alkaline or strongly alkaline. Lime is disseminated throughout the horizons.

The Bk horizon has value of 4 or 5 when moist and 6 or 7 when dry and has chroma of 2 when moist or dry. It has common or many distinct or prominent mottles. Reaction is moderately alkaline or mildly alkaline. Lime is disseminated throughout the horizon.

The 2C horizon has value of 5 or 6 when moist and 7 or 8 when dry and has chroma of 2 when moist or dry. Reaction is moderately alkaline or mildly alkaline.

The 3C horizon has value of 5 or 6 when moist and 6 or 7 when dry and has chroma of 2 when moist or dry. It has common or many distinct or prominent mottles. It is sandy clay loam or clay loam having 25 to 35 percent clay. Reaction is moderately alkaline or mildly alkaline.

Halfway Series

The Halfway series consists of deep, moderately well drained soils in level or slightly depressional areas on alluvial fans or flood plains. These soils formed in fine textured, mixed alluvium. Slope is 0 to 3 percent. Elevation is 2,700 to 3,400 feet. The average annual precipitation is 18 to 22 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 110 to 130 days.

Typical pedon of Halfway clay, 0 to 3 percent slopes, about 1 mile west of Halfway, in the center of SW¼SE¼ sec. 7, T. 8 S., R. 46 E.

Ap—0 to 4 inches; black (10YR 2/1) clay, dark gray (10YR 4/1) dry; strong fine granular structure; hard, friable, very sticky and very plastic; many very fine and fine roots; many very fine irregular pores; neutral (pH 6.8); abrupt smooth boundary.

A1—4 to 16 inches; black (10YR 2/1) clay, very dark gray (10YR 3/1) dry; strong coarse prismatic structure; very hard, very firm, very sticky and very plastic; few fine roots; common very fine tubular pores; common pressure faces, few intersecting slickensides; neutral (pH 6.8); gradual smooth boundary.

A2—16 to 22 inches; black (10YR 2/1) clay, very dark gray (10YR 3/1) dry; strong coarse prismatic structure parting to coarse angular blocky; very hard, very firm, very sticky and very plastic; few fine roots; common very fine tubular pores; many intersecting slickensides; neutral (pH 6.8); gradual smooth boundary.

AC—22 to 34 inches; very dark brown (10YR 2/2) clay, dark grayish brown (10YR 4/2) dry; strong medium prismatic structure parting to angular blocky; very hard, very firm, very sticky and very plastic; few fine roots; common very fine tubular pores; neutral (pH 6.8); clear smooth boundary.

C1—34 to 44 inches; dark brown (10YR 3/3) clay loam, grayish brown (10YR 5/2) dry; moderate medium angular blocky structure; hard, firm, sticky and plastic; few fine roots; common very fine tubular pores; neutral (pH 6.8); gradual smooth boundary.

C2—44 to 60 inches; dark yellowish brown (10YR 3/4) clay loam, grayish brown (10YR 5/2) dry; weak medium angular blocky structure; hard, firm, slightly sticky and slightly plastic; common very fine tubular pores; neutral (pH 6.8).

The depth to bedrock is more than 60 inches. The soils have cracks that open and close once each year and remain open for 60 consecutive days or more.

The A horizon has value of 2 or 3 when moist and 3 or 4 when dry and has chroma of 1 or less when moist or dry.

The AC horizon has value of 2 or 3 when moist and 3 or 4 when dry and has chroma of 2 or 3 when moist or dry.

The C horizon is clay loam or clay having 35 to 60 percent clay. It is neutral or mildly alkaline.

Hall Ranch Series

The Hall Ranch series consists of moderately deep, well drained soils on mountains. These soils formed in mixed volcanic ash, loess, and colluvium derived from andesite and basalt. Slope is 2 to 12 percent. Elevation is 4,400 to 5,400 feet. The average annual precipitation is 20 to 30 inches, the average annual temperature is 40 to 45 degrees F, and the average frost-free period is 50 to 90 days.

Typical pedon of Hall Ranch stony loam, 2 to 12 percent slopes, SW¼SE¼SW¼ sec. 16, T. 13 S., R. 36 E.

Oi—1 inch to 0; partially decomposed needles, leaves, and twigs.

A—0 to 6 inches; very dark brown (10YR 2/2) stony loam, dark grayish brown (10YR 4/2) dry; weak very fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; many very fine and fine roots; many very fine and fine tubular pores; about 15 percent stones and 10 percent gravel; slightly acid (pH 6.4); clear smooth boundary.

BA—6 to 15 inches; very dark grayish brown (10YR 3/2) gravelly loam, grayish brown (10YR 5/2) dry; moderate very fine and fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine and fine tubular pores; about 15 percent gravel; slightly acid (pH 6.4); gradual smooth boundary.

Bw1—15 to 26 inches; dark brown (10YR 4/3) gravelly loam, brown (10YR 5/3) dry; moderate fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and few medium roots; many very fine and fine tubular pores; about 20 percent gravel; neutral (pH 6.6); gradual smooth boundary.

Bw2—26 to 37 inches; dark brown (10YR 4/3) gravelly clay loam, brown (10YR 5/3) dry; moderate fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and few medium roots; many very fine and fine tubular pores; about 25 percent gravel; neutral (pH 6.6); abrupt smooth boundary.

2Cr—37 inches; highly weathered andesite tuff.

The depth to paralithic contact is 20 to 40 inches. The mollic epipedon is 10 to 20 inches thick. Reaction is slightly acid or neutral throughout the solum. Hue is 10YR or 7.5YR.

The A horizon has value of 2 or 3 when moist and 3 to 5 when dry and has chroma of 2 or 3 when moist or dry. It has 10 to 15 percent stones and cobbles and 5 to 10 percent gravel.

The Bw horizon has value of 3 or 4 when moist and 4 or 5 when dry and has chroma of 2 to 4 when moist or dry. It is loam or clay loam having 20 to 30 percent clay, 15 to 30 percent gravel, and 0 to 10 percent cobbles.

Hankins Series

The Hankins series consists of deep, well drained soils on mountains. These soils formed in colluvium derived from tuffaceous sediments and influenced by volcanic ash in the surface layer. Slope is 2 to 35 percent. Elevation is 4,000 to 5,000 feet. The average annual precipitation is 16 to 30 inches, the average annual temperature is 40 to 45 degrees F, and the average frost-free period is 30 to 50 days.

Typical pedon of Hankins silt loam, 12 to 35 percent north slopes, SW¼SW¼NW¼ sec. 32, T. 11 S., R. 37 E.

Oi—1 inch to 0; partially decomposed litter of needles, twigs, and leaves.

A—0 to 4 inches; very dark gray (10YR 3/1) silt loam, grayish brown (10YR 5/2) dry; weak very fine and fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; many very fine and fine roots; many very fine and fine tubular pores; about 10 percent gravel; slightly acid (pH 6.4); clear smooth boundary.

BA—4 to 9 inches; very dark grayish brown (10YR 3/2) silt loam, brown (10YR 5/3) dry; moderate fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine and few medium and coarse roots; many very fine and fine tubular pores; about 10 percent gravel; neutral (pH 6.6); abrupt smooth boundary.

2Bt1—9 to 16 inches; dark brown (10YR 3/3) gravelly silty clay, brown (10YR 5/3) dry; strong coarse prismatic structure; hard, firm, sticky and plastic; common fine and few medium and coarse roots; common fine tubular pores; many distinct clay films on faces of peds and lining pores; about 20 percent gravel; neutral (pH 6.6); abrupt smooth boundary.

2Bt2—16 to 28 inches; dark brown (10YR 4/3) gravelly clay, yellowish brown (10YR 5/4) dry; strong coarse prismatic structure; very hard, very firm, very sticky and very plastic; common very fine tubular pores; many prominent clay films on faces of peds; about 30 percent gravel; neutral (pH 6.8); gradual smooth boundary.

2Bt3—28 to 47 inches; dark brown (10YR 4/3) gravelly clay, yellowish brown (10YR 5/4) dry; strong coarse prismatic structure; very hard, very firm, very sticky and very plastic; few very fine tubular pores; many prominent clay films on faces of peds; about 30 percent gravel; neutral (pH 6.8); gradual smooth boundary.

3Cr—47 inches; weathered tuffaceous bedrock.

The depth to bedrock is typically 40 to 60 inches but is more than 60 inches in some pedons. The mollic epipedon is 10 to more than 20 inches thick. Reaction is slightly acid or neutral throughout the solum.

The A horizon has value of 2 or 3 when moist and 3 to 5 when dry and has chroma of 1 or 2 when moist or dry. It is silt loam or very cobbly loam having 5 to 10 percent gravel and 0 to 35 percent cobbles and stones.

The BA horizon is silt loam or gravelly clay loam. Some pedons do not have a BA horizon.

The Bt horizon has value of 3 or 4 when moist and 4 or 5 when dry and has chroma of 3 or 4 when moist or dry. It is silty clay or clay having 50 to 60 percent clay, 10 to 20 percent gravel, and 0 to 10 percent cobbles.

Harlow Series

The Harlow series consists of shallow, well drained soils on mountains. These soils formed in colluvium derived from argillite, rhyolitic tuff, and breccia. Slope is 3 to 60 percent. Elevation is 4,000 to 5,700 feet. The average annual precipitation is 16 to 20 inches, the average annual temperature is 40 to 45 degrees F, and the average frost-free period is 50 to 90 days.

Typical pedon of Harlow extremely stony clay loam, 3 to 12 percent slopes, NW¼NW¼NE¼ sec. 19, T. 11 S., R. 37 E.

A—0 to 4 inches; very dark grayish brown (10YR 3/2) extremely stony clay loam, dark grayish brown (10YR 4/2) dry; moderate fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine and fine tubular pores; about 35 percent stones, 15 percent cobbles, and 20 percent gravel; neutral (pH 6.8); clear smooth boundary.

BA—4 to 12 inches; dark brown (10YR 3/3) extremely gravelly clay loam, brown (10YR 5/3) dry; moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine and fine tubular pores; about 50 percent gravel and 15 percent cobbles; neutral (pH 6.8); clear wavy boundary.

Bt—12 to 18 inches; dark brown (10YR 3/3) extremely cobbly clay, brown (10YR 4/3) dry; strong medium and coarse subangular blocky structure; hard, firm, sticky and plastic; few fine roots; few very fine and fine tubular pores; many distinct clay films on faces

of peds; about 50 percent cobbles and 20 percent gravel; neutral (pH 6.6); abrupt wavy boundary.
2R—18 inches; highly fractured argillite.

The depth to a lithic contact is 10 to 20 inches.

The A horizon has value of 2 or 3 when moist and 3 or 4 when dry and has chroma of 2 or 3 when moist or dry. It has 30 to 40 percent stones, 15 to 20 percent cobbles, and 15 to 20 percent gravel.

The Bt horizon has value of 2 or 3 when moist and 4 or 5 when dry and has chroma of 2 or 3 when moist or dry. It is clay or clay loam having 35 to 50 percent clay, 30 to 50 percent cobbles, and 15 to 30 percent gravel.

Hershal Series

The Hershal series consists of deep, poorly drained soils on flood plains. These soils formed in mixed alluvium. Slope is 0 to 2 percent. Elevation is 2,300 to 3,400 feet. The average annual precipitation is 18 to 22 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 110 to 130 days.

Typical pedon of Hershal silt loam, 0 to 2 percent slopes, 60 feet north of Clear Creek and 40 feet east of road, 1,200 feet north and 2,800 feet east of the southwest corner of sec. 14, T. 8 S., R. 46 E.

A1—0 to 8 inches; very dark brown (10YR 2/2) silt loam, dark grayish brown (10YR 4/2) dry; weak fine and medium granular structure; hard, friable, slightly sticky and slightly plastic; many roots; few very fine and fine tubular pores; neutral (pH 7.0); clear smooth boundary.
A2—8 to 16 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; few fine distinct yellowish brown (10YR 5/6) mottles; moderate fine and medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common roots; many very fine tubular pores; neutral (pH 7.0); abrupt smooth boundary.
C1—16 to 24 inches; very dark grayish brown (10YR 3/2) very fine sandy loam, grayish brown (10YR 5/2) dry; many medium distinct yellowish brown (10YR 5/6) mottles; massive; slightly hard, friable, nonsticky and nonplastic; few roots; few fine and very fine tubular pores; neutral (pH 7.0); abrupt smooth boundary.
2C2—24 to 60 inches; multicolored very gravelly sand; single grain; loose, nonsticky and nonplastic; about 40 percent gravel and 10 percent cobbles.

The depth to bedrock is more than 60 inches. The depth to very gravelly sand is 20 to 40 inches.

The A horizon has value of 3 to 5 when dry and has chroma of 1 or 2 when moist or dry. The surface has 0 to 10 percent gravel. The A2 horizon has few to many mottles.

The C1 horizon has hue of 10YR to 5Y and may be gleyed. It has value of 2 or 3 when moist and 4 or 5 when dry and has chroma of 0 to 2 when moist or dry. It is very fine sandy loam or silt loam having 0 to 10 percent gravel.

The 2C2 horizon is very gravelly loamy sand, gravelly sand, or very gravelly sand having 20 to 60 percent gravel and 0 to 15 percent cobbles.

Hibbard Series

The Hibbard series consists of moderately deep to a duripan, well drained soils on terraces and fan terraces. These soils formed in mixed alluvium. Slope is 2 to 12 percent. Elevation is 3,000 to 3,700 feet. The average annual precipitation is 12 to 16 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 110 to 130 days.

Typical pedon of Hibbard gravelly silty clay loam, 2 to 12 percent slopes, 1,400 feet south and 150 feet east of the northwest corner of sec. 25, T. 9 S., R. 42 E.

A—0 to 5 inches; very dark gray (10YR 3/1) gravelly silty clay loam, gray (10YR 5/1) dry; moderate fine and medium subangular blocky structure; hard, firm, sticky and plastic; many very fine and fine roots; few very fine and fine irregular pores; about 25 percent gravel and 3 percent cobbles; neutral (pH 6.8); clear smooth boundary.
AB—5 to 9 inches; very dark grayish brown (10YR 3/2) gravelly silty clay loam, grayish brown (10YR 5/2) dry; moderate medium subangular blocky structure; hard, firm, sticky and plastic; common very fine and fine roots; few very fine tubular pores; about 15 percent gravel; neutral (pH 7.0); abrupt smooth boundary.
2Bt1—9 to 19 inches; very dark grayish brown (10YR 3/2) clay, brown (10YR 5/3) dry; strong coarse subangular blocky structure; very hard, very firm, very sticky and very plastic; few very fine and fine roots; few very fine tubular pores; many prominent clay films on faces of peds and lining pores; about 5 percent gravel; mildly alkaline (pH 7.4); clear wavy boundary.
2Bt2—19 to 28 inches; dark brown (10YR 4/3) silty clay, yellowish brown (10YR 5/4) dry; moderate coarse subangular blocky structure; hard, firm, sticky and plastic; few very fine roots; few very fine tubular pores; many distinct clay films on faces of peds and lining pores; moderately alkaline (pH 8.0); clear smooth boundary.

2BCk—28 to 34 inches; yellowish brown (10YR 5/4) silty clay loam, pale brown (10YR 6/3) dry; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; strongly effervescent; moderately alkaline (pH 8.2); abrupt smooth boundary.

3Ckqm1—34 to 45 inches; brownish yellow (10YR 6/6) and very pale brown (10YR 8/3), indurated duripan; massive; very hard; laminar capping on surface and in fractures; violently effervescent; strongly alkaline (pH 8.6); abrupt wavy boundary.

3Ckqm2—45 to 60 inches; yellow (10YR 7/6), indurated duripan; massive; extremely hard; violently effervescent; strongly alkaline (pH 8.6).

The depth to bedrock is more than 60 inches. Depth to the duripan is 20 to 40 inches.

The A and AB horizons have value of 2 or 3 when moist and 4 or 5 when dry and have chroma of 1 or 2 when moist or dry. They are silt loam or gravelly silty clay loam having 0 to 25 percent gravel and 0 to 5 percent cobbles.

The 2Bt horizon has value of 2 or 3 when moist and 4 or 5 when dry and has chroma of 2 to 4 when moist or dry. It is clay or silty clay having 40 to 60 percent clay, 0 to 10 percent gravel, and 0 to 5 percent cobbles.

The 2BCk horizon has value of 4 to 6 when moist or dry and has chroma of 3 or 4 when moist or dry. It is silty clay loam or clay loam. It is slightly effervescent to violently effervescent.

The 3Ckqm horizon is indurated throughout or is indurated in the upper few inches and weakly cemented to strongly cemented in the lower part. It is massive or platy.

Highhorn Series

The Highhorn series consists of deep, well drained soils on mountains. These soils formed in colluvium derived from argillite and influenced by volcanic ash in the surface layer. Slope is 12 to 75 percent. Elevation is 3,800 to 7,200 feet. The average annual precipitation is 20 to 30 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 45 to 90 days.

Typical pedon of Highhorn very gravelly silt loam, in an area of Highhorn-Huntrock very gravelly silt loams, 12 to 30 percent south slopes, 300 feet north of the center of sec. 35, T. 8 S., R. 38 E.

Oi—3 inches to 0; partially decomposed pine needles, grass, and twigs.

A1—0 to 4 inches; black (10YR 2/1) very gravelly silt loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; soft, very friable, nonsticky and nonplastic; moderately smeary; many very fine and fine roots; many very fine irregular pores; about 40 percent gravel; moderately acid (pH 6.0); clear smooth boundary.

A2—4 to 9 inches; very dark brown (10YR 2/2) very gravelly silt loam, dark brown (10YR 3/3) dry; moderate fine and medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; weakly smeary; common very fine and fine roots; common very fine and fine irregular pores; about 35 percent gravel; moderately acid (pH 6.0); clear smooth boundary.

2BA—9 to 16 inches; dark brown (10YR 3/3) very gravelly silty clay loam, yellowish brown (10YR 5/4) dry; moderate fine and medium subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; few fine and medium roots; few fine and medium tubular pores; about 45 percent gravel; slightly acid (pH 6.2); clear smooth boundary.

2Bwb1—16 to 23 inches; brown (10YR 4/3) very gravelly silty clay loam, light yellowish brown (10YR 6/4) dry; strong fine and medium subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; few fine and medium roots; few fine and medium tubular pores; about 45 percent gravel; slightly acid (pH 6.2); clear smooth boundary.

2Bwb2—23 to 32 inches; dark yellowish brown (10YR 4/4) very gravelly silty clay loam, light yellowish brown (10YR 6/4) dry; strong medium and coarse subangular blocky structure parting to fine subangular blocky; hard, very firm, sticky and plastic; few fine and medium roots; few fine and medium tubular pores; common faint clay films on faces of peds; about 50 percent gravel; slightly acid (pH 6.4); clear wavy boundary.

2Bwb3—32 to 43 inches; yellowish brown (10YR 5/4) extremely gravelly silty clay loam, light yellowish brown (10YR 6/4) dry; strong medium and coarse subangular blocky structure; hard, firm, slightly sticky and slightly plastic; about 70 percent gravel; neutral (pH 6.6); abrupt smooth boundary.

3R—43 inches; argillite.

The depth to bedrock is 40 to 60 inches. Hue is 10YR or 7.5YR.

The A horizon has value of 2 or 3 when moist and 4 or 5 when dry and has chroma of 1 to 3 when moist or dry. It has 35 to 50 percent gravel and 0 to 10 percent cobbles.

The 2Bwb horizon has value of 4 or 5 when moist and 5 or 6 when dry and has chroma of 3 or 4 when moist or dry. It is silty clay loam or clay loam having 35 to 70 percent gravel and 0 to 10 percent cobbles.

Hudspeth Series

The Hudspeth series consists of moderately deep, well drained soils on side slopes of mountains. These soils formed in colluvium derived from tuffaceous sediments over metamorphic bedrock. Slope is 12 to 60 percent. Elevation is 4,000 to 5,700 feet. The average annual precipitation is 16 to 30 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 50 to 90 days.

Typical pedon of Hudspeth very stony clay loam, in an area of Hudspeth-Morningstar complex, 35 to 60 percent south slopes, NW¼NE¼NW¼ sec. 29, T. 11 S., R. 37 E.

Oi—1 inch to 0; partially decomposed pine needles, leaves, and twigs.

A—0 to 7 inches; very dark grayish brown (10YR 3/2) very stony clay loam, dark grayish brown (10YR 4/2) dry; moderate fine subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; many very fine and fine and few medium roots; many very fine and fine tubular pores; about 25 percent stones, 15 percent gravel, and 10 percent cobbles; slightly acid (pH 6.4); abrupt smooth boundary.

2Bt1—7 to 16 inches; dark brown (10YR 3/3) very gravelly clay, brown (10YR 5/3) dry; strong medium angular blocky structure; very hard, very firm, very sticky and very plastic; few medium roots; common very fine tubular pores; many prominent dark clay films on faces of peds and lining pores; about 40 percent gravel and 10 percent cobbles; neutral (pH 6.6); gradual smooth boundary.

2Bt2—16 to 27 inches; dark brown (10YR 4/3) very gravelly clay, brown (10YR 5/3) dry; strong medium and coarse angular blocky structure; very hard, very firm, very sticky and very plastic; few medium roots; common very fine tubular pores; many continuous prominent clay films on faces of peds and lining pores; about 40 percent gravel and 10 percent cobbles; neutral (pH 6.6); gradual smooth boundary.

2Bt3—27 to 34 inches; dark yellowish brown (10YR 4/4) extremely gravelly clay, yellowish brown (10YR 5/4) dry; strong coarse prismatic structure; very hard, very firm, very sticky and very plastic; few very fine tubular pores; many prominent clay films on faces of peds and lining pores; about 50 percent gravel and 15 percent cobbles; neutral (pH 6.8); abrupt wavy boundary.

3R—34 inches; fractured argillite.

The depth to bedrock is 20 to 40 inches. Depth to the 2Bt horizon is 5 to 15 inches. The mollic epipedon is 10 to 20 inches thick. Reaction is slightly acid or neutral throughouot the solum.

The A horizon has value of 2 or 3 when moist and 4 or 5 when dry and has chroma of 2 or 3 when moist or dry. It has 15 to 30 percent stones, 10 to 15 percent cobbles, and 10 to 20 percent gravel.

The 2Bt horizon has value of 3 to 5 when moist and 5 or 6 when dry and has chroma of 3 or 4 when moist or dry. It is clay or silty clay having 50 to 60 percent clay, 40 to 50 percent gravel, and 10 to 20 percent cobbles or stones. The structure is moderate or strong angular or subangular blocky grading to moderate or strong prismatic.

Huntrock Series

The Huntrock series consists of moderately deep, well drained soils on mountains. These soils formed in colluvium derived from argillite and influenced by volcanic ash in the surface layer. Slope is 12 to 75 percent. Elevation is 3,800 to 7,200 feet. The average annual precipitation is 20 to 30 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 45 to 90 days.

Typical pedon of Huntrock very gravelly silt loam, in an area of Highhorn-Huntrock very gravelly silt loams, 30 to 50 percent south slopes, 2,400 feet south and 700 feet east of the northwest corner of sec. 35, T. 8 S., R. 38 E.

Oi—1½ inches to 0; partially decomposed pine needles, grass, and twigs.

A1—0 to 3 inches; black (10YR 2/1) very gravelly silt loam, dark grayish brown (10YR 4/2) dry; weak fine and medium granular structure; soft, very friable, nonsticky and nonplastic; moderately smeary; common very fine and fine roots; common very fine and fine irregular pores; about 40 percent gravel; slightly acid (pH 6.2); clear smooth boundary.

A2—3 to 7 inches; very dark brown (10YR 2/2) very gravelly silt loam, grayish brown (10YR 5/2) dry; weak fine and medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; moderately smeary; common very fine and fine roots; common very fine and fine irregular pores; about 45 percent gravel; neutral (pH 6.6); clear smooth boundary.

AB—7 to 12 inches; very dark grayish brown (10YR 3/2) very gravelly silt loam, pale brown (10YR 6/3) dry; moderate medium and coarse subangular blocky structure; soft, friable, nonsticky and nonplastic; weakly smeary; common fine and few very fine roots; common fine tubular pores, 50 percent gravel; neutral (pH 6.8); clear smooth boundary.

2Bwb1—12 to 25 inches; dark brown (10YR 4/3) extremely gravelly clay loam, light yellowish brown (10YR 6/4) dry; strong medium and coarse subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; common fine and medium roots; common fine and medium tubular pores; about 55 percent gravel and 5 percent cobbles; neutral (pH 6.8); clear wavy boundary.
2Bwb2—25 to 35 inches; yellowish brown (10YR 5/4) extremely cobbly clay loam, brownish yellow (10YR 6/6) dry; moderate fine and medium subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; about 50 percent cobbles and 15 percent gravel; neutral (pH 6.8); abrupt wavy boundary.
3R—35 inches; argillite.

The depth to bedrock is 20 to 40 inches. Hue is 10YR or 7.5YR.

The A horizon has value of 2 or 3 when moist and 4 to 6 when dry and has chroma of 1 to 3 when moist or dry. It has 35 to 50 percent gravel and 0 to 10 percent cobbles.

The 2Bwb horizon has value of 4 or 5 when moist and 5 or 6 when dry and has chroma of 3 to 6 when moist or dry. It is clay loam or silty clay loam having 15 to 60 percent gravel and 5 to 50 percent cobbles.

Hyall Series

The Hyall series consists of deep over bedrock and moderately deep to consolidated gravelly alluvium, well drained soils on terrace side slopes. These soils formed in mixed alluvium. Slope is 12 to 60 percent. Elevation is 2,700 to 3,500 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 120 days.

Typical pedon of Hyall very gravelly clay loam, in an area of Hyall-Simas association, 35 to 60 percent slopes, about 3 miles northwest of Richland, on a west-facing slope 300 feet downslope from terrace top, 1,300 feet north and 700 feet east of the southwest corner of sec. 9, T. 9 S., R. 45 E.

A1—0 to 3 inches; very dark grayish brown (10YR 3/2) very gravelly clay loam, dark brown (10YR 3/3) dry; moderate fine and medium granular structure; slightly hard, firm, slightly sticky and slightly plastic; common very fine and fine roots; common very fine and fine tubular pores; about 40 percent gravel and 10 percent cobbles; neutral (pH 7.0); clear smooth boundary.
A2—3 to 8 inches; very dark grayish brown (10YR 3/2) very gravelly clay, dark brown (10YR 3/3) dry; moderate medium and fine subangular blocky structure; hard, firm, sticky and plastic; few very fine and fine roots; common very fine and few fine tubular pores; about 35 percent gravel and 10 percent cobbles; neutral (pH 7.0); clear smooth boundary.
Bt1—8 to 14 inches; dark brown (10YR 3/3) very gravelly clay, dark brown (10YR 3/3) dry; strong medium subangular blocky structure; very hard, very firm, very sticky and very plastic; few very fine and fine roots; common very fine tubular pores; many faint clay films on faces of peds; about 40 percent gravel and 10 percent cobbles; neutral (pH 7.0); clear smooth boundary.
Bt2—14 to 26 inches; dark brown (10YR 3/3) extremely gravelly clay, dark yellowish brown (10YR 3/4) dry; strong medium angular blocky structure; hard, firm, sticky and plastic; few very fine roots; few very fine tubular pores; many distinct clay films on faces of peds; about 55 percent gravel and 15 percent cobbles; neutral (pH 7.2); abrupt smooth boundary.
2C—26 to 60 inches; multicolored extremely gravelly loamy sand; strongly consolidated; about 60 percent gravel and 15 percent cobbles; mildly alkaline (pH 7.4).

The depth to bedrock is more than 60 inches. Depth to the 2C horizon is 20 to 40 inches.

The A horizon has value of 2 or 3 when moist and 3 or 4 when dry and has chroma of 2 or 3 when moist or dry. It has 30 to 50 percent gravel and 5 to 10 percent cobbles.

The Bt horizon has value of 3 or 4 when moist or dry and has chroma of 3 or 4 when dry and 2 or 3 when moist. It has 25 to 60 percent gravel and 10 to 15 percent cobbles. Reaction is mildly alkaline or neutral.

The 2C horizon is strongly consolidated extremely gravelly or extremely cobbly alluvium having 50 to 60 percent gravel and 10 to 25 percent cobbles. It is loamy sand, sandy loam, or clay loam. Reaction is neutral or mildly alkaline.

Immig Series

The Immig series consists of moderately deep, well drained soils on hills. These soils formed in colluvium derived from basalt and influenced by loess and volcanic ash in the surface layer. Slope is 2 to 70 percent. Elevation is 2,000 to 4,000 feet. The average annual precipitation is 14 to 20 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 120 days.

Typical pedon of Immig very cobbly silt loam, in an area of Gwinly-Immig very cobbly silt loams, 12 to 35 percent south slopes, about 5 miles north of Richland, 1,000 feet south and 1,400 feet west of the northeast corner of sec. 25, T. 8 S., R. 45 E.

A1—0 to 7 inches; very dark grayish brown (10YR 3/2) very cobbly silt loam, dark brown (10YR 3/3) dry; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and common fine and medium roots; common fine irregular pores; about 10 percent gravel, 40 percent cobbles, and 3 percent stones; slightly acid (pH 6.2); gradual wavy boundary.

A2—7 to 12 inches; dark brown (7.5YR 3/2) very cobbly silty clay loam, dark brown (7.5YR 3/4) dry; moderate fine and medium subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; common very fine and fine roots; common fine irregular pores; about 15 percent gravel and 40 percent cobbles; slightly acid (pH 6.2); clear wavy boundary.

Bt1—12 to 22 inches; dark brown (7.5YR 3/4) very cobbly clay, dark brown (7.5YR 3/4) dry; moderate medium subangular blocky structure; hard, firm, sticky and plastic; common very fine and few fine roots; few fine and medium tubular and irregular pores; common faint clay films on faces of peds; about 15 percent gravel and 45 percent cobbles; slightly acid (pH 6.2); abrupt irregular boundary.

Bt2—22 to 26 inches; olive brown (2.5Y 4/4) extremely cobbly clay, dark yellowish brown (10YR 4/4) dry; moderate fine subangular blocky structure; very hard, very firm, sticky and plastic; few very fine roots, mainly in cracks; few fine tubular and irregular pores; many faint clay films on faces of peds and lining pores; about 10 percent gravel and 65 percent cobbles; slightly acid (pH 6.2); abrupt wavy boundary.

2R—26 inches; hard basalt.

The thickness of the solum and the depth to bedrock are 20 to 40 inches. The mollic epipedon is 10 to 20 inches thick.

The A1 horizon has hue of 7.5YR or 10YR, value of 2 or 3 when moist and 2 to 4 when dry, and chroma of 2 or 3 when moist or dry. It is silt loam or very cobbly silt loam having 5 to 15 percent gravel, 0 to 45 percent cobbles, and 0 to 10 percent stones.

The A2 horizon has hue of 7.5YR or 10YR, value of 2 or 3 when moist and 3 or 4 when dry, and chroma of 2 to 4 when moist or dry. It has 10 to 20 percent gravel, 20 to 45 percent cobbles, and 0 to 10 percent stones.

The Bt horizon has hue of 7.5YR to 2.5YR, value of 3 or 4 when moist and 3 to 5 when dry, and chroma of 3 to 6 when moist or dry. It has 5 to 15 percent gravel and 40 to 70 percent cobbles.

Inkler Series

The Inkler series consists of deep, well drained soils on mountains. These soils formed in colluvium derived from rhyolite and andesite and influenced by volcanic ash in the surface layer. Slope is 2 to 70 percent. Elevation is 4,000 to 6,000 feet. The average annual precipitation is 20 to 30 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 30 to 60 days.

Typical pedon of Inkler very gravelly loam, 50 to 70 percent north slopes, about 2.5 miles east of Dooley Mountain Road, NW¼SW¼NE¼ sec. 10, T. 12 S., R. 40 E.

Oi—2 inches to ¾ inch; undecomposed pine needles, grass, and twigs.

Oe—¾ inch to 0; partially decomposed pine needles, grass, and twigs.

A—0 to 4 inches; very dark brown (10YR 2/2) very gravelly loam, grayish brown (10YR 5/2) dry; weak very fine granular structure; slightly hard, very friable, nonsticky and nonplastic; many very fine and fine roots; many very fine and fine irregular pores; about 40 percent gravel; neutral (pH 7.2); clear wavy boundary.

Bw1—4 to 12 inches; dark brown (10YR 3/3) very gravelly loam, light brownish gray (10YR 6/2) dry; weak fine subangular blocky structure parting to weak fine granular; slightly hard, very friable, nonsticky and nonplastic; many very fine and fine roots; many very fine and fine tubular pores; about 40 percent gravel and 15 percent cobbles; neutral (pH 7.2); clear irregular boundary.

Bw2—12 to 23 inches; brown (10YR 4/3) extremely gravelly loam, pale brown (10YR 6/3) dry; weak fine subangular blocky structure parting to weak fine granular; slightly hard, very friable, nonsticky and nonplastic; common fine and medium roots; many very fine tubular pores; about 50 percent gravel, 15 percent cobbles, and 5 percent stones; neutral (pH 7.2); clear wavy boundary.

2C1—23 to 39 inches; brown (10YR 5/3) extremely cobbly loam, very pale brown (10YR 7/3) dry; massive; slightly hard, very friable, nonsticky and nonplastic; few fine and medium roots; many fine tubular pores; about 40 percent gravel and 35 percent cobbles; neutral (pH 7.2); gradual wavy boundary.

2C2—39 to 48 inches; brown (10YR 5/3) extremely cobbly loam, very pale brown (10YR 7/3) dry; massive; slightly hard, very friable, nonsticky and nonplastic; few fine and medium roots; many fine and few medium tubular pores; about 40 percent gravel and 35 percent cobbles; neutral (pH 7.2); clear wavy boundary.

2C3—48 to 62 inches; yellowish brown (10YR 5/4) extremely cobbly loam, very pale brown (10YR 7/3) dry; massive; slightly hard, friable, nonsticky and nonplastic; few fine roots; many fine and few medium tubular pores; about 50 percent cobbles; neutral (pH 7.2).

The depth to bedrock is more than 60 inches. The thickness of the part of the profile that is influenced by ash is 14 to 24 inches. Some pedons have a Cr horizon.

The A horizon has value of 2 to 4 when moist and 4 or 5 when dry and has chroma of 2 or 3 when moist or dry. It has 15 to 45 percent gravel and 0 to 5 percent cobbles.

The Bw horizon has value of 3 or 4 when moist and 5 or 6 when dry and has chroma of 2 or 3 when moist or dry. It is loam or silt loam having 20 to 50 percent gravel, 0 to 20 percent cobbles, and 0 to 5 percent stones.

The C horizon has value of 4 or 5 when moist and 6 or 7 when dry and has chroma of 3 or 4 when moist or dry. It is loam or sandy loam having 35 to 55 percent gravel, 5 to 35 percent cobbles, and 0 to 10 percent stones.

Jett Series

The Jett series consists of deep, well drained soils on flood plains and low terraces. These soils formed in mixed alluvium high in volcanic ash. Slope is 0 to 3 percent. Elevation is 2,200 to 3,600 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 115 to 150 days.

Typical pedon of Jett silt loam, 0 to 3 percent slopes, 2 miles west of Bridgeport, 2,240 feet east and 2,290 feet south of the northwest corner of sec. 26, T. 12 S., R. 40 E.

Ap—0 to 8 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; weak fine granular and weak fine subangular blocky structure; soft, friable, slightly sticky and slightly plastic; many very fine roots; many irregular pores; many earthworm casts; strongly effervescent; moderately alkaline (pH 8.2); clear smooth boundary.

A—8 to 24 inches; black (10YR 2/1) silt loam, gray (10YR 5/1) dry; weak medium subangular blocky structure; soft, friable, slightly sticky and slightly plastic; many very fine roots; common very fine to coarse tubular pores; many earthworm casts; strongly effervescent; moderately alkaline (pH 8.2); gradual smooth boundary.

C1—24 to 38 inches; very dark brown (10YR 2/2) silt loam, gray (10YR 5/1) dry; massive; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; common very fine and fine tubular pores; moderately alkaline (pH 7.9); clear smooth boundary.

C2—38 to 51 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; massive; slightly hard, friable, slightly sticky and slightly plastic; common fine roots; common very fine tubular pores; mildly alkaline (pH 7.8); clear smooth boundary.

C3—51 to 60 inches; dark brown (10YR 3/3) silt loam, light brownish gray (10YR 6/2) dry; massive; slightly hard, friable, slightly sticky and slightly plastic; few roots; common very fine, fine, and medium tubular pores; mildly alkaline (pH 7.7).

The depth to bedrock is more than 60 inches. The mollic epipedon is more than 20 inches thick. Reaction is mildly alkaline or moderately alkaline throughout the profile. The soils are calcareous in all or some part of the A horizon.

The Ap and A horizons have value of 2 or 3 when moist and 4 or 5 when dry and have chroma of 1 or 2 when moist or dry.

The C horizon has value of 2 to 4 when moist and 4 to 6 when dry and has chroma of 1 to 3 when moist or dry. In some pedons it has faint fine mottles below a depth of 40 inches. It is silt loam to a depth of 60 inches.

Kahler Series

The Kahler series consists of deep, well drained soils on mountains. These soils formed in mixed volcanic ash, loess, and colluvium derived from andesite and basalt. Slope is 12 to 60 percent. Elevation is 4,400 to 5,800 feet. The average annual precipitation is 20 to 30 inches, the average annual temperature is 40 to 45 degrees F, and the average frost-free period is 30 to 50 days.

Typical pedon of Kahler loam, in an area of McGarr-Kahler complex, 35 to 60 percent north slopes, SW¼SE¼SE¼ sec. 16, T. 13 S., R. 36 E.

Oi—1 inch to 0; partially decomposed needles, leaves, and twigs.

A1—0 to 5 inches; very dark grayish brown (10YR 3/2) loam, dark grayish brown (10YR 4/2) dry; weak very fine subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine and fine tubular pores; about 10 percent gravel; neutral (pH 6.6); clear smooth boundary.

A2—5 to 13 inches; very dark grayish brown (10YR 3/2) silty clay loam, grayish brown (10YR 5/2) dry; moderate very fine and fine subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine and fine tubular pores; about 10 percent gravel; neutral (pH 6.6); clear smooth boundary.

Bw1—13 to 22 inches; dark brown (10YR 3/3) gravelly loam, brown (10YR 5/3) dry; moderate fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine and fine tubular pores; about 15 percent gravel; slightly acid (pH 6.4); clear smooth boundary.

Bw2—22 to 37 inches; dark brown (10YR 4/3) gravelly silty clay loam, brown (10YR 5/3) dry; moderate fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and few medium roots; many very fine and fine tubular pores; about 15 percent gravel; slightly acid (pH 6.4); gradual smooth boundary.

2C—37 to 60 inches; dark brown (10YR 4/3) loam, brown (10YR 5/3) dry; moderate fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and few medium roots; many very fine and fine tubular pores; about 10 percent gravel; slightly acid (pH 6.4).

The depth to bedrock is typically more than 60 inches but is 40 to 60 inches in some pedons. The mollic epipedon is 20 to 30 inches thick. Reaction is slightly acid or neutral throughout the profile. Hue is 10YR or 7.5YR.

The A horizon has value of 2 or 3 when moist and 4 or 5 when dry and has chroma of 2 or 3 when moist or dry. It has 0 to 20 percent gravel and 0 to 5 percent cobbles.

The Bw horizon has value of 3 or 4 when moist and 4 or 5 when dry and has chroma of 2 to 4 when moist or dry. It is loam, clay loam, or silty clay loam having 20 to 30 percent clay, 0 to 20 percent gravel, and 0 to 5 percent cobbles.

The 2C horizon has value of 3 or 4 when moist and 5 or 6 when dry and has chroma of 2 to 4 when moist or dry. It is loam or silt loam having 10 to 20 percent gravel and 0 to 5 percent cobbles.

Keating Series

The Keating series consists of moderately deep, well drained soils on hills. These soils formed in colluvium derived from greenstone and influenced by loess and volcanic ash in the surface layer. Slope is 2 to 35 percent. Elevation is 3,000 to 3,800 feet. The average annual precipitation is 12 to 16 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 130 days.

Typical pedon of Keating silt loam, in an area of Clovercreek-Keating complex, 2 to 12 percent slopes, about 3 miles south of Medical Springs, NE¼NE¼ sec. 24, T. 7 S., R. 41 E.

Ap—0 to 8 inches; very dark brown (10YR 2/2) silt loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; soft, friable, slightly sticky and slightly plastic; many very fine roots; many very fine tubular pores; neutral (pH 6.6); abrupt smooth boundary.

2BA—8 to 12 inches; dark brown (10YR 3/3) clay loam, brown (10YR 4/3) dry; moderate fine subangular blocky structure; hard, friable, sticky and plastic; common very fine roots; many very fine tubular pores; neutral (pH 6.6); clear smooth boundary.

2Bt1—12 to 17 inches; dark brown (7.5YR 3/4) clay loam, brown (10YR 4/3) dry; moderate fine subangular blocky structure; hard, firm, sticky and plastic; few fine roots; many very fine tubular pores; common distinct clay films on faces of peds and lining pores; neutral (pH 6.6); clear smooth boundary.

2Bt2—17 to 22 inches; dark yellowish brown (10YR 3/4) clay, dark brown (10YR 4/3) dry; moderate fine subangular blocky structure; hard, firm, very sticky and very plastic; few fine roots; many very fine tubular pores; common distinct clay films on faces of peds and lining pores; neutral (pH 6.6); abrupt wavy boundary.

3R—22 inches; fractured greenstone.

The depth to bedrock is 20 to 40 inches. Hue is 10YR or 7.5YR.

The Ap horizon has value of 2 or 3 when moist and 4 or 5 when dry and has chroma of 1 or 2 when moist or dry. It has 0 to 10 percent gravel.

The 2BA horizon has value of 2 or 3 when moist and 4 or 5 when dry and has chroma of 2 or 3 when moist or dry. It is clay loam or silty clay loam having 0 to 5 percent gravel.

The 2Bt horizon has value of 3 or 4 when moist and 4 or 5 when dry and has chroma of 3 or 4 when moist or dry. It is clay, silty clay, or clay loam having 0 to 10 percent gravel and 0 to 5 percent cobbles.

Kilmerque Series

The Kilmerque series consists of moderately deep, well drained soils on mountains. These soils formed in colluvium derived from quartz diorite and related granitic rocks and influenced by volcanic ash in the surface layer. Slope is 12 to 80 percent. Elevation is 3,900 to 5,500 feet. The average annual precipitation is 17 to 30 inches, the average annual air temperature is 41 to 45 degrees F, and the average frost-free period is 80 to 100 days.

Typical pedon of Kilmerque loam, 12 to 35 percent south slopes, about 7 miles northwest of Haines, 50 feet west of dirt road at the top of the hill, SE¼NW¼SW¼ sec. 22, T. 7 S., R. 38 E.

Oi—½ inch to 0; partially decomposed pine needles and twigs.

A1—0 to 2 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; moderate fine and medium granular structure; soft, very friable, nonsticky and nonplastic; common very fine to medium roots; many very fine tubular pores; neutral (pH 6.6); clear smooth boundary.

A2—2 to 5 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; moderate fine granular structure parting to weak medium subangular blocky; soft, friable, nonplastic and nonsticky; common very fine to medium roots; common very fine tubular pores; neutral (pH 6.6); clear wavy boundary.

Bw1—5 to 12 inches; dark brown (10YR 3/3) loam, brown (10YR 5/3) dry; moderate coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine to medium and few coarse roots; common very fine tubular pores; neutral (pH 6.6); clear wavy boundary.

Bw2—12 to 16 inches; dark yellowish brown (10YR 4/4) sandy loam, yellowish brown (10YR 5/4) dry; weak medium and coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few fine and medium roots; common very fine tubular pores; neutral (pH 6.8); clear wavy boundary.

C—16 to 26 inches; yellowish brown (10YR 5/4) gravelly coarse sandy loam, yellowish brown (10YR 5/6) dry; massive; hard, friable, nonsticky and nonplastic; few medium roots; few very fine tubular pores; about 30 percent gravel; neutral (pH 6.9); gradual wavy boundary.

Cr—26 inches; partially decomposed quartz diorite.

The depth to paralithic contact is 20 to 40 inches. The mollic epipedon is 10 to 20 inches thick. Reaction is slightly acid or neutral in the solum and substratum.

The A horizon has value of 2 or 3 when moist and 4 or 5 when dry and has chroma of 2 or 3 when moist or dry. It has 0 to 10 percent fine gravel.

The Bw horizon has value of 3 or 4 when moist and 4 or 5 when dry and has chroma of 3 to 6 when moist or dry. It is loam or sandy loam having 0 to 10 percent gravel.

The C horizon has value of 4 to 6 and chroma of 4 to 6 when moist or dry. It is gravelly or cobbly coarse sandy loam. It has 20 to 35 percent gravel.

Klicker Series

The Klicker series consists of moderately deep, well drained soils on mountains. These soils formed in colluvium derived from basalt and andesite. Slope is 12 to 60 percent. Elevation is 3,300 to 6,000 feet. The average annual precipitation is 17 to 30 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 60 to 90 days.

Typical pedon of Klicker stony silt loam, 12 to 35 percent south slopes, SW¼NW¼SE¼ sec. 16, T. 13 S., R. 36 E.

Oi—2 inches to 0; partially decomposed needles, leaves, and twigs.

A—0 to 5 inches; very dark brown (10YR 2/2) stony silt loam, dark brown (10YR 4/3) dry; weak very fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; many very fine and fine and few medium roots; many fine tubular pores; about 15 percent stones, 10 percent gravel, and 5 percent cobbles; neutral (pH 6.8); clear wavy boundary.

AB—5 to 13 inches; dark brown (7.5YR 3/2) very cobbly silt loam, brown (7.5YR 4/4) dry; moderate fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine and few medium roots; many fine tubular pores; about 20 percent gravel and 20 percent cobbles; slightly acid (pH 6.4); clear wavy boundary.

Bt1—13 to 27 inches; dark reddish brown (5YR 3/4) very cobbly silty clay loam, reddish brown (5YR 4/4) dry; moderate fine subangular blocky structure; slightly hard, firm, sticky and plastic; common fine and few medium roots; common fine tubular pores; common faint clay films; about 15 percent gravel and 35 percent cobbles; moderately acid (pH 6.0); gradual wavy boundary.

Bt2—27 to 36 inches; dark reddish brown (5YR 3/4) very cobbly silty clay loam, reddish brown (5YR 4/4) dry; moderate fine and medium subangular blocky structure; hard, firm, sticky and plastic; common fine and few medium roots; common fine tubular pores; few faint clay films; about 40 percent cobbles and 15 percent gravel; moderately acid (pH 6.0); clear wavy boundary.

2R—36 inches; highly weathered and fractured andesite.

The thickness of the solum and the depth to bedrock are 20 to 40 inches.

The A horizon has value of 2 or 3 when moist and 4 or 5 when dry and has chroma of 2 or 3 when moist or dry. It has 5 to 15 percent gravel, 0 to 15 percent cobbles, and 5 to 15 percent stones.

The AB horizon has value of 2 or 3 when moist and 3 or 4 when dry and has chroma of 2 to 4 when moist or dry. It has 15 to 25 percent gravel and 10 to 30 percent cobbles.

The Bt horizon has value of 3 when moist and 4 or 5 when dry and has chroma of 2 to 4 when moist or dry. It is silty clay loam, clay loam, or loam having 10 to 20 percent gravel, 20 to 40 percent cobbles, and 0 to 20 percent stones.

Ladd Series

The Ladd series consists of deep, well drained soils on foot slopes and fans. These soils formed in alluvium and colluvium of mixed origin. Slope is 2 to 12 percent. Elevation is 3,400 to 4,000 feet. The average annual precipitation is 12 to 16 inches, the average annual air temperature is 45 to 48 degrees F, and the average frost-free period is 100 to 120 days.

Typical pedon of Ladd loam, 2 to 7 percent slopes, about 5 miles west of Haines, SE¼SE¼ sec. 34, T. 7 S., R. 38 E.

Ap—0 to 8 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine and medium roots; many very fine irregular pores; neutral (pH 6.6); clear smooth boundary.

Bt1—8 to 16 inches; dark brown (10YR 3/3) loam, brown (10YR 5/3) dry; weak coarse prismatic structure; hard, friable, slightly sticky and slightly plastic; common fine and medium roots; many very fine tubular pores; common faint clay films on faces of peds; slightly acid (pH 6.4); clear wavy boundary.

Bt2—16 to 32 inches; brown (10YR 4/3) clay loam, pale brown (10YR 6/3) dry; weak coarse prismatic structure; hard, friable, slightly sticky and slightly plastic; common fine roots; many very fine and fine tubular pores; common faint clay films on faces of peds and lining pores; few dark brown krotovinas; slightly acid (pH 6.2); clear wavy boundary.

C1—32 to 46 inches; brown (10YR 4/3) loam, pale brown (10YR 6/3) dry; massive; hard, firm, slightly sticky and slightly plastic; few roots; many very fine and fine tubular pores; slightly acid (pH 6.2); clear smooth boundary.

2C2—46 to 62 inches; dark yellowish brown (10YR 4/4) clay loam, light yellowish brown (10YR 6/4) dry; massive; hard, firm, sticky and plastic; many very fine and fine tubular pores; neutral (pH 6.6).

The depth to bedrock is more than 60 inches. The mollic epipedon is 10 to 20 inches thick.

The Ap horizon has value of 4 or 5 when dry and 2 or 3 when moist and has chroma of 2 or 3 when moist or dry. The structure is granular or platy.

The Bt horizon has value of 4 or 5 when moist and 4 to 6 when dry and has chroma of 2 to 4 when moist or dry. It is sandy clay loam, clay loam, or loam. The structure is weak coarse prismatic to moderate medium prismatic and subangular blocky.

The C and 2C horizons have value of 4 or 5 when moist and 5 or 6 when dry and have chroma of 3 or 4 when moist or dry. They are sandy clay loam, clay loam, or loam. In some pedons the lower part of the 2C2 horizon is calcareous.

La Grande Series

The La Grande series consists of deep, well drained soils on flood plains and low terraces. These soils formed in mixed alluvium high in volcanic ash. Slope is 0 to 3 percent. Elevation is 2,400 to 3,200 feet. The average annual precipitation is 18 to 22 inches, the average annual air temperature is 46 to 49 degrees F, and the average frost-free period is 110 to 130 days.

Typical pedon of La Grande silt loam, 0 to 3 percent slopes, about 1 mile north of Halfway, in the northwest corner of NW¼SE¼ sec. 5, T. 8 S., R. 46 E.

Ap—0 to 8 inches; black (10YR 2/1) silt loam, very dark grayish brown (10YR 3/2) dry; moderate fine and medium granular and fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; many very fine and fine tubular and irregular pores; neutral (pH 7.0); gradual smooth boundary.

A1—8 to 28 inches; black (10YR 2/1) silt loam, very dark grayish brown (10YR 3/2); moderate medium subangular blocky and granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; many very fine and common fine tubular pores; neutral (pH 7.0); gradual smooth boundary.

A2—28 to 39 inches; black (10YR 2/1) silt loam, very dark grayish brown (10YR 3/2) dry; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine roots; common very fine tubular pores; neutral (pH 6.8); abrupt smooth boundary.

C1—39 to 56 inches; dark brown (10YR 3/3) very fine sandy loam, brown (10YR 5/4) dry; massive; soft, friable, nonsticky and nonplastic; neutral (pH 6.6); gradual smooth boundary.

C2—56 to 60 inches; dark yellowish brown (10YR 3/4) very fine sandy loam, yellowish brown (10YR 5/4) dry; massive; slightly hard, friable, nonsticky and nonplastic; slightly acid (pH 6.4); about 5 percent gravel.

The depth to bedrock is more than 60 inches. The mollic epipedon is 20 to 40 inches thick.

The A horizon has value of 1 or 2 when moist and 3 or 4 when dry and has chroma of 1 or 2 when moist or dry.

The C horizon is silt loam or very fine sandy loam having 0 to 15 percent gravel. In some pedons it has mottles.

La Grande soils in this survey area are a taxadjunct to the La Grande series because they are well drained rather than moderately well drained. In the La Grande soils in this survey area, mottles are in the lower part of the C horizon and a water table is at a depth of 5 to 6 feet from March through May. The La Grande series is defined as having mottles at a depth of 20 to 40 inches and a water table at a depth of 2 to 4 feet from February through May. These differences, however, do not significantly affect use and management.

Langrell Series

The Langrell series consists of deep, well drained soils on outwash terraces. These soils formed in mixed glaciofluvial deposits. Slope is 0 to 3 percent. Elevation is 2,500 to 3,400 feet. The average annual precipitation is 18 to 22 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 110 to 130 days.

Typical pedon of Langrell gravelly loam, 0 to 3 percent slopes, 1 mile north of the town of Langrell in Pine Valley, 1,250 feet south of the northeast corner of sec. 36, T. 7 S., R. 45 E.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) gravelly loam, grayish brown (10YR 5/2) dry; moderate fine granular structure; soft, friable, slightly sticky and slightly plastic; common very fine and fine roots; many very fine tubular and irregular pores; about 20 percent gravel; neutral (pH 7.0); abrupt smooth boundary.

Bw1—7 to 20 inches; dark brown (10YR 3/3) gravelly loam, brown (10YR 5/3) dry; weak fine subangular blocky structure; soft, friable, slightly sticky and slightly plastic; common fine roots; many very fine pores; about 25 percent gravel and 5 percent cobbles; neutral (pH 7.0); gradual smooth boundary.

2Bw2—20 to 34 inches; dark brown (10YR 3/3) extremely cobbly loam, brown (10YR 5/3) dry; weak fine and medium subangular blocky structure; soft, friable, slightly sticky and slightly plastic; few roots; about 30 percent gravel and 40 percent cobbles; neutral (pH 7.0); gradual smooth boundary.

3C—34 to 60 inches; dark brown (7.5YR 3/2) very stony sandy loam, brown (10YR 4/3) dry; massive; soft, friable, nonsticky and nonplastic; about 20 percent gravel, 25 percent cobbles, and 15 percent stones; neutral (pH 6.8).

The depth to bedrock is more than 60 inches. The solum and the mollic epipedon are 20 to 40 inches thick.

The A horizon has value of 2 or 3 when moist and 4 or 5 when dry and has chroma of 2 or 3 when moist or dry. It is gravelly loam or very cobbly loam having 10 to 30 percent gravel, 0 to 20 percent cobbles, and 0 to 5 percent stones.

The Bw and 2Bw horizons have value of 2 or 3 when moist and 4 or 5 when dry and have chroma of 2 or 3 when moist or dry. They have 20 to 40 percent gravel, 10 to 40 percent cobbles, and 0 to 20 percent stones.

The 3C horizon has hue of 10YR or 7.5YR, value of 3 or 4 when moist and 4 to 6 when dry, and chroma of 2 or 3 when moist or dry. It is sandy loam having 20 to 50 percent gravel, 25 to 40 percent cobbles, and 5 to 15 percent stones.

Legler Series

The Legler series consists of deep, well drained soils on incised flood plains and fans. These soils formed in alluvium that is influenced by volcanic ash and loess in the surface layer. Slope is 2 to 20 percent. Elevation is 2,800 to 3,600 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 110 to 130 days.

Typical pedon of Legler silt loam, 2 to 8 percent slopes, on Virtue Flat, south of road, NE¼NE¼SW¼ sec. 10, T. 9 S., R. 41 E.

A1—0 to 3 inches; very dark grayish brown (10YR 3/2) silt loam, brown (10YR 5/3) dry; weak fine and medium granular structure; soft, very friable, nonsticky and nonplastic; common very fine and fine roots; few very fine pores; neutral (pH 7.2); clear smooth boundary.

A2—3 to 9 inches; dark brown (10YR 3/3) silt loam, brown (10YR 5/3) dry; moderate medium and coarse subangular blocky structure; soft, friable, nonsticky and nonplastic; common very fine and fine roots; few very fine and fine tubular pores; mildly alkaline (pH 7.6); clear smooth boundary.

AB—9 to 13 inches; dark brown (10YR 3/3) loam, pale brown (10YR 6/3) dry; strong thin platy structure;

slightly hard, friable, nonsticky and nonplastic; common very fine and fine roots; common very fine tubular pores; mildly alkaline (pH 7.6); clear smooth boundary.

Bw1—13 to 19 inches; dark brown (10YR 3/3) loam, pale brown (10YR 6/3) dry; strong fine and medium prismatic structure parting to fine and medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; few very fine and fine tubular pores; mildly alkaline (pH 7.8); clear smooth boundary.

Bw2—19 to 31 inches; dark brown (10YR 3/3) silt loam, pale brown (10YR 6/3) dry; moderate fine and medium subangular blocky structure; soft, friable, nonsticky and nonplastic; few very fine and fine roots; common very fine and fine tubular pores; moderately alkaline (pH 8.0); gradual smooth boundary.

Bw3—31 to 49 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; moderate fine and medium subangular blocky structure; slightly hard, firm, nonsticky and nonplastic; moderately alkaline (pH 8.2); gradual smooth boundary.

Bk—49 to 60 inches; brown (10YR 4/3) silt loam, very pale brown (10YR 7/3) dry; weak fine and medium subangular blocky structure; soft, friable, nonsticky and nonplastic; slightly effervescent; moderately alkaline (pH 8.4).

The depth to bedrock is more than 60 inches.

The A horizon has value of 3 or 4 when moist and 5 or 6 when dry and has chroma of 2 or 3 when moist or dry. It is silt loam or gravelly loam having 0 to 25 percent gravel.

The AB and Bw1 horizons have value of 3 or 4 when moist and have chroma of 3 or 4 when moist or dry.

The Bw2 and Bw3 horizons have value of 3 or 4 when moist and 6 or 7 when dry and have chroma of 3 or 4 when moist or dry. They are silt loam or silty clay loam. They are mildly alkaline or moderately alkaline. The Bk horizon has the same range in colors as the Bw2 and Bw3 horizons. It is slightly effervescent or strongly effervescent. It is silt loam, silty clay loam, or silty clay. Some pedons do not have a Bk horizon.

Lickskillet Series

The Lickskillet series consists of shallow, well drained soils on hills. These soils formed in colluvium derived from metavolcanics and basalt. Slope is 30 to 70 percent. Elevation is 2,000 to 3,600 feet. The average annual precipitation is 10 to 12 inches, the average annual air temperature is 47 to 50 degrees F, and the average frost-free period is 110 to 150 days.

Typical pedon of Lickskillet very gravelly sandy loam, 50 to 70 percent south slopes, about 2 miles northeast of Huntington, on a 60 percent slope, about 100 feet above road, SW¼SW¼ sec. 8, T. 14 S., R. 45 E.

A—0 to 6 inches; very dark grayish brown (10YR 3/2) very gravelly sandy loam, grayish brown (10YR 5/2) dry; moderate fine granular structure; soft, friable, nonsticky and nonplastic; common fine roots; common fine and very fine irregular pores; about 50 percent gravel and 5 percent cobbles; slightly effervescent; moderately alkaline (pH 8.0); clear wavy boundary.

BA—6 to 10 inches; dark brown (10YR 3/3) very gravelly clay loam, brown (10YR 5/3) dry; weak fine granular structure; soft, friable, slightly sticky and slightly plastic; common fine roots; common fine and very fine tubular pores; about 40 percent gravel and 10 percent small lime coated angular cobbles; strongly effervescent; moderately alkaline (pH 8.0); gradual wavy boundary.

Bw—10 to 18 inches; brown (10YR 4/3) very cobbly clay loam, brown (10YR 5/3) dry; weak fine to medium subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; few fine roots; few fine tubular pores; about 25 percent cobbles and 35 percent gravel; strongly effervescent; moderately alkaline (pH 8.0); abrupt wavy boundary.

2R—18 inches; hard fractured metaandesite.

The depth to bedrock is 12 to 20 inches.

The A horizon has value of 2 or 3 when moist and 4 or 5 when dry and has chroma of 2 or 3 when moist or dry. It is very cobbly loam or very gravelly sandy loam having 30 to 60 percent gravel and 0 to 35 percent cobbles. Reaction is neutral to moderately alkaline.

The BA horizon is very gravelly clay loam or very gravelly sandy clay loam. Some pedons do not have a BA horizon.

The Bw horizon has hue of 10YR or 7.5YR, value of 3 or 4 when moist, and chroma of 3 or 4 when moist or dry. It has 35 to 60 percent gravel and 0 to 20 percent cobbles. Reaction is neutral to moderately alkaline.

Longbranch Series

The Longbranch series consists of deep, well drained soils on side slopes of hills. These soils formed in colluvium derived from greenstone. Slope is 12 to 50 percent. Elevation is 3,800 to 5,700 feet. The average annual precipitation is 12 to 16 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 50 to 90 days.

Typical pedon of Longbranch silt loam, in an area of Roostercomb-Longbranch complex, 12 to 35 percent north slopes, SE¼SW¼SW¼ sec. 14, T. 12 S., R. 41 E.

A1—0 to 4 inches; very dark gray (10YR 3/1) silt loam, grayish brown (10YR 5/2) dry; moderate very fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine and fine roots; many very fine and fine irregular pores; about 5 percent gravel; neutral (pH 6.6); clear smooth boundary.

A2—4 to 22 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; moderate fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; common very fine and fine and few medium roots; many very fine and fine tubular pores; about 10 percent gravel; neutral (pH 6.8); abrupt wavy boundary.

2BA—22 to 30 inches; very dark grayish brown (10YR 3/2) gravelly clay loam, brown (10YR 5/3) dry; moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine and few medium roots; many very fine and fine tubular pores; about 20 percent gravel and 5 percent cobbles; neutral (pH 7.0); abrupt smooth boundary.

2Bt—30 to 38 inches; yellowish brown (10YR 5/4) very gravelly clay, light yellowish brown (10YR 6/4) dry; moderate medium and coarse angular blocky structure; hard, firm, sticky and plastic; few very fine roots; common very fine and fine tubular pores; common distinct clay films on faces of peds and lining pores; about 30 percent gravel and 10 percent cobbles; neutral (pH 7.2); gradual smooth boundary.

2Btk1—38 to 45 inches; yellowish brown (10YR 5/4) very cobbly clay, light yellowish brown (10YR 6/4) dry; moderate medium and coarse subangular blocky structure; hard, firm, sticky and plastic; common very fine and fine tubular pores; many prominent clay films on faces of peds and lining pores; strongly effervescent with segregated lime blotches; about 30 percent gravel and 25 percent cobbles; mildly alkaline (pH 7.6); clear smooth boundary.

2Btk2—45 to 52 inches; light yellowish brown (10YR 6/4) extremely cobbly clay loam, very pale brown (10YR 7/4) dry; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine tubular pores; few faint clay films lining pores; strongly effervescent; about 45 percent cobbles and 20 percent gravel; mildly alkaline (pH 7.8); gradual smooth boundary.

3R—52 inches; highly fractured greenstone.

The depth to bedrock is typically 40 to 60 inches but is more than 60 inches in some pedons. The mollic epipedon is 20 to 30 inches thick. Reaction is neutral or mildly alkaline throughout the solum. Depth to the 2Bt horizon is 20 to 30 inches.

The A horizon has value of 2 or 3 when moist and 3 to 5 when dry and has chroma of 1 or 2 when moist or dry. It has 5 to 10 percent gravel and 0 to 5 percent cobbles.

The 2BA horizon has value of 3 or 4 when moist and 4 or 5 when dry and has chroma of 2 or 3 when moist or dry. It is silty clay loam or clay loam having 27 to 35 percent clay, 20 to 30 percent gravel, and 0 to 10 percent cobbles and stones.

The 2Bt and 2Btk1 horizons have value of 4 or 5 when moist and 5 or 6 when dry and have chroma of 3 or 4 when moist or dry. They are silty clay or clay having 40 to 50 percent clay, 20 to 30 percent gravel, and 10 to 30 percent cobbles and stones.

The 2Btk2 horizon has value of 5 or 6 when moist and 6 or 7 when dry and has chroma of 3 or 4 when moist or dry. It has 20 to 40 percent gravel and 30 to 50 percent cobbles and stones. It is strongly effervescent or violently effervescent.

Lookout Series

The Lookout series consists of well drained soils on hills. These soils are moderately deep to a duripan. They formed in colluvium derived from basalt and influenced by volcanic ash and loess in the surface layer. Slope is 2 to 12 percent. Elevation is 2,800 to 3,600 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 45 to 48 degrees F, and the average frost-free period is 110 to 140 days.

Typical pedon of Lookout very cobbly silt loam, 2 to 12 percent slopes, 1,200 feet east and 900 feet north of the southwest corner of sec. 20, T. 7 S., R. 41 E.

A1—0 to 7 inches; very dark grayish brown (10YR 3/2) very cobbly silt loam, light brownish gray (10YR 6/2) dry; weak fine subangular blocky structure parting to fine and medium granular; slightly hard, friable, nonsticky and nonplastic; common very fine and fine roots; common very fine and fine tubular pores; about 35 percent cobbles and 10 percent gravel; neutral (pH 6.8); clear smooth boundary.

A2—7 to 15 inches; dark brown (10YR 3/3) very cobbly silt loam, pale brown (10YR 6/3) dry; moderate fine subangular blocky structure; hard, firm, slightly sticky and slightly plastic; common very fine and fine roots; common very fine and fine tubular pores; about 25 percent cobbles and 10 percent gravel; mildly alkaline (pH 7.4); abrupt smooth boundary.

2Btk—15 to 26 inches; dark yellowish brown (10YR 4/4) clay, yellowish brown (10YR 5/4) dry; strong coarse subangular blocky structure; very hard, very firm, sticky and plastic; many distinct clay films on faces of peds and lining pores; strongly effervescent; about 5 percent cobbles and 5 percent gravel; moderately alkaline (pH 8.4); abrupt wavy boundary.

2Bkqm—26 to 37 inches; pale brown (10YR 6/3), silica-cemented duripan; indurated plates; weakly cemented material between the plates; laminar coating on surfaces of the plates; abrupt wavy boundary.

3R—37 inches; hard basalt.

Depth to the duripan is 20 to 40 inches. The depth to bedrock is 30 to 50 inches. Hue is 10YR or 7.5YR.

The A horizon has value of 3 or 4 when moist and 6 or 7 when dry and has chroma of 2 or 3 when moist or dry. It is silt loam or very cobbly silt loam having 0 to 20 percent gravel, 0 to 40 percent cobbles, and 0 to 10 percent stones.

The 2Btk horizon has value of 4 or 5 when moist and 5 to 7 when dry and has chroma of 3 or 4 when moist or dry. It is clay or silty clay having 0 to 10 percent cobbles and 0 to 10 percent gravel.

The 2Bkqm is platy and has weakly cemented to strongly cemented lime and soil material between indurated plates. The duripan is 10 to 20 inches thick.

Lostbasin Series

The Lostbasin series consists of moderately deep, well drained soils on hills. These soils formed in colluvium derived from schist and graywacke. Slope is 12 to 80 percent. Elevation is 4,000 to 5,300 feet. The average annual precipitation is 12 to 16 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 70 to 100 days.

Typical pedon of Lostbasin very channery loam, in an area of Lostbasin-Xerorthents-Rock outcrop complex, 35 to 50 percent south slopes, about 7 miles northeast of Bridgeport on Windy Ridge, NE¼SW¼SE¼ sec. 35, T. 11 S., R. 41 E.

A—0 to 5 inches; dark grayish brown (10YR 4/2) very channery loam, light brownish gray (10YR 6/2) dry; weak very fine and fine subangular blocky structure; soft, friable, nonsticky and nonplastic; many very fine and fine roots; many very fine and fine tubular pores; about 45 percent channers and 5 percent flagstones; neutral (pH 7.2); abrupt smooth boundary.

BA—5 to 13 inches; brown (10YR 4/3) extremely channery clay loam, pale brown (10YR 6/3) dry; moderate fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; many very fine and fine tubular pores; about 55 percent channers and 5 percent flagstones; neutral (pH 7.0); clear smooth boundary.

Bw1—13 to 23 inches; dark yellowish brown (10YR 4/4) extremely channery clay loam, light gray (10YR 7/2) dry; moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; common fine tubular pores; about 60 percent channers and 5 percent flagstones; neutral (pH 7.0); clear smooth boundary.

Bw2—23 to 28 inches; yellowish brown (10YR 5/4) extremely channery clay loam, very pale brown (10YR 7/3) dry; moderate fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots; common very fine tubular pores; about 70 percent channers and 5 percent flagstones; neutral (pH 6.8); abrupt wavy boundary.

R—28 inches; highly fractured schist.

The depth to bedrock is 20 to 40 inches.

The A horizon has value of 3 or 4 when moist and 5 or 6 when dry and has chroma of 2 or 3 when moist or dry. It has 30 to 45 percent channers and 5 to 10 percent flagstones.

The Bw horizon has value of 4 or 5 when moist and 6 or 7 when dry and has chroma of 3 or 4 when moist or dry. It is loam or clay loam having 25 to 35 percent clay, 40 to 70 percent channers, and 0 to 10 percent flagstones.

Lovline Series

The Lovline series consists of moderately deep, well drained soils on hills. These soils formed in colluvium derived from schist. Slope is 2 to 70 percent. Elevation is 2,000 to 3,600 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 45 to 49 degrees F, and the frost-free period is 100 to 140 days.

Typical pedon of Lovline channery loam, 50 to 70 percent north slopes, about 100 feet west of the Snake River Road on an east-facing slope between Fox Creek and Hibbard Creek, NE¼SW¼ sec. 22, T. 12 S., R. 45 E.

A—0 to 9 inches; very dark grayish brown (10YR 3/2) channery loam, grayish brown (10YR 5/2) dry; weak thin platy structure; soft, friable, slightly sticky and slightly plastic; common roots; many very fine tubular pores; about 20 percent channers; neutral (pH 7.0); clear smooth boundary.

Bw1—9 to 20 inches; dark brown (10YR 3/3) channery loam, grayish brown (10YR 5/2) dry; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common roots; many very fine tubular pores; about 20 percent channers; neutral (pH 7.0); gradual wavy boundary.

Bw2—20 to 38 inches; dark yellowish brown (10YR 3/4) channery loam, brown (10YR 5/3) dry; weak fine subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few roots; many very fine and fine pores; about 20 percent channers; neutral (pH 7.2); abrupt wavy boundary.

R—38 inches; fractured schist.

The depth to bedrock is 20 to 40 inches. The mollic epipedon is 10 to 20 inches thick.

The A and Bw1 horizons have value of 2 or 3 when moist and 4 or 5 when dry and have chroma of 2 or 3 when moist or dry. They have 10 to 30 percent channers.

The Bw2 horizon has value of 3 or 4 when moist and 5 or 6 when dry and has chroma of 3 or 4 when moist or dry. It is loam or clay loam having 18 to 35 percent clay and 0 to 35 percent channers.

Marack Series

The Marack series consists of deep, well drained soils on low terraces. These soils formed in lacustrine sediments. Slope is 2 to 35 percent. Elevation is 3,800 to 4,400 feet. The average annual precipitation is 9 to 12 inches, the average annual temperature is 40 to 45 degrees F, and the average frost-free period is 60 to 90 days.

Typical pedon of Marack gravelly silty clay loam, in an area of Marack complex, 2 to 12 percent slopes, 600 feet west and 1,100 feet south of the northeast corner of sec. 21, T. 13 S., R. 37 E.

A1—0 to 2 inches; very dark grayish brown (10YR 3/2) gravelly silty clay loam, grayish brown (10YR 5/2) dry; moderate medium granular structure; soft, friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine and fine irregular pores; about 25 percent gravel; neutral (pH 6.8); clear smooth boundary.

A2—2 to 12 inches; very dark grayish brown (10YR 3/2) gravelly silty clay loam, grayish brown (10YR 5/2) dry; moderate fine subangular blocky structure; soft, friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine and fine tubular pores; about 20 percent gravel; neutral (pH 6.8); abrupt smooth boundary.

Bt—12 to 17 inches; dark brown (10YR 4/3) clay, brown (10YR 5/3) dry; strong coarse subangular blocky structure; hard, firm, very sticky and very plastic; common very fine and fine roots; many very fine and fine tubular pores; many prominent clay films on faces of peds and lining pores; neutral (pH 7.2); clear smooth boundary.

Btk—17 to 25 inches; dark yellowish brown (10YR 4/4) silty clay, yellowish brown (10YR 5/4) dry; moderate medium subangular blocky structure; hard, firm, sticky and plastic; common very fine and fine roots; common very fine and fine tubular pores; common distinct clay films on faces of peds and lining pores; slightly effervescent; segregated lime blotches; mildly alkaline (pH 7.6); clear smooth boundary.

Bk1—25 to 34 inches; yellowish brown (10YR 5/4) clay loam, light yellowish brown (10YR 6/4) dry; moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; few very fine tubular pores; strongly effervescent with disseminated lime; moderately alkaline (pH 8.2); clear smooth boundary.

2Bk2—34 to 47 inches; yellowish brown (10YR 5/4) very gravelly loam, very pale brown (10YR 7/3) dry; weak fine subangular blocky structure; soft, friable, nonsticky and nonplastic; few very fine roots; few very fine tubular pores; strongly effervescent with disseminated lime; moderately alkaline (pH 8.4); abrupt wavy boundary.

3Crk—47 inches; consolidated lacustrine sediments; strongly effervescent with disseminated lime; strongly alkaline (pH 8.6).

The depth to lacustrine sediments is typically 40 to 60 inches but is more than 60 inches in some pedons. Depth to the Bt horizon is 10 to 20 inches.

The A horizon has value of 2 or 3 when moist and 4 or 5 when dry and has chroma of 1 or 2 when moist or dry. It is silty clay loam or silt loam having 0 to 30 percent gravel.

The Bt horizon has value of 3 or 4 when moist and 5 or 6 when dry and has chroma of 3 or 4 when moist or dry. It is clay or silty clay having 40 to 50 percent clay and 0 to 10 percent gravel. The structure is moderate or strong.

The Btk horizon has value of 3 or 4 when moist and 5 or 6 when dry and has chroma of 3 or 4 when moist or dry. It is clay or silty clay having 0 to 10 percent gravel. It is slightly effervescent to strongly effervescent and has lime that is in segregated blotches or disseminated.

The Bk1 horizon has value of 6 or 7 when dry and 5 to 6 when moist and has chroma of 3 or 4 when moist or dry. It is clay loam or silty clay loam. It has 0 to 15 percent gravel. It is strongly effervescent to violently effervescent and has disseminated lime.

The 2Bk horizon has value of 4 to 6 when moist and 6 or 7 when dry and has chroma of 3 or 4 when moist or dry. It is loam, sandy loam, or silt loam having 0 to 40 percent gravel and 0 to 10 percent cobbles. It is strongly effervescent to violently effervescent and has disseminated lime.

McEwen Series

The McEwen series consists of deep, well drained soils on alluvial terraces and side slopes. These soils formed in mixed alluvium that is influenced by loess and volcanic ash in the surface layer. Slope is 2 to 20 percent. Elevation is 3,900 to 4,400 feet. The average annual precipitation is 16 to 24 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 50 to 90 days.

Typical pedon of McEwen silt loam, 2 to 12 percent slopes, about 5 miles east of Sumpter, in the center of SW¼SW¼ sec. 8, T. 10 S., R. 38 E.

Oi—1 inch to 0; partially decomposed litter of needles, leaves, and twigs.

A—0 to 4 inches; dark brown (7.5YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine and medium roots; many very fine tubular pores; neutral (pH 6.6); abrupt smooth boundary.

AB—4 to 12 inches; dark brown (7.5YR 3/4) silt loam, pale brown (10YR 6/3) dry; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many fine and medium roots; many very fine tubular pores; neutral (pH 6.6); clear smooth boundary.

2Bt1—12 to 18 inches; dark brown (7.5YR 3/4) clay loam, light brown (7.5YR 6/4) dry; moderate fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common roots; many very fine tubular pores; few faint clay films on faces of peds and in pores; neutral (pH 6.6); clear smooth boundary.

2Bt2—18 to 30 inches; dark reddish brown (5YR 3/4) clay loam, reddish brown (5YR 5/3) dry; moderate medium subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; common roots; common very fine tubular pores; common faint and few distinct clay films on faces of peds and in pores; neutral (pH 6.6); clear smooth boundary.

2Bt3—30 to 43 inches; dark reddish brown (5YR 3/4) clay loam, reddish brown (5YR 5/3) dry; weak medium subangular blocky structure; hard, firm, sticky and plastic; common roots; common fine to coarse tubular pores; few faint clay films on faces of peds and in pores; about 10 percent gravel; few fine black concretions and stains; neutral (pH 6.6); clear smooth boundary.

3C—43 to 60 inches; dark reddish brown (5YR 3/4) extremely gravelly loam, light reddish brown (5YR 6/4) dry; massive; loose, friable, slightly sticky and slightly plastic; few roots; about 50 percent gravel and 10 percent cobbles; neutral (pH 6.8).

The depth to bedrock is more than 60 inches. The depth to very gravelly or extremely gravelly alluvium is 40 to 60 inches.

The A and AB horizons have hue of 10YR or 7.5YR, value of 3 or 4 when moist and 5 or 6 when dry, and chroma of 2 to 4 when moist or dry. They have 0 to 20 percent gravel and 0 to 5 percent cobbles.

The Bt horizon has hue of 5YR or 7.5YR, value of 3 or 4 when moist and 5 or 6 when dry and has chroma of 3 or 4 when moist or dry. It is clay loam or silty clay loam having 27 to 35 percent clay, 0 to 20 percent gravel, and 0 to 10 percent cobbles.

The 3C horizon is loam or sandy loam. It has 40 to 50 percent gravel and 5 to 20 percent cobbles.

McGarr Series

The McGarr series consists of moderately deep, well drained soils on mountains. These soils formed in mixed volcanic ash, loess, and colluvium derived from andesite and basalt. Slope is 12 to 65 percent. Elevation is 3,300 to 5,800 feet. The average annual precipitation is 16 to 30 inches, the average annual temperature is 40 to 45 degrees F, and the average frost-free period is 30 to 60 days.

Typical pedon of McGarr very stony loam, in an area of McGarr-Kahler complex, 12 to 35 percent north slopes, SW¼SE¼NW¼ sec. 27, T. 12 S., R. 36 E.

Oi—1 inch to 0; partially decomposed needles, leaves, and twigs.

A1—0 to 4 inches; very dark grayish brown (10YR 3/2) very stony loam, dark grayish brown (10YR 4/2) dry; weak very fine granular structure; soft, very friable, slightly sticky and slightly plastic; many very fine and fine and few medium roots; many very fine and fine tubular pores; about 20 percent stones, 15 percent cobbles, and 5 percent gravel; neutral (pH 6.6); clear smooth boundary.

A2—4 to 13 inches; very dark grayish brown (10YR 3/2) gravelly loam, dark grayish brown (10YR 4/2) dry; moderate very fine subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; many very fine and fine and few medium roots; many very fine and fine tubular pores; about 15 percent gravel; neutral (pH 6.6); clear smooth boundary.

Bw1—13 to 22 inches; dark brown (10YR 3/3) gravelly loam, brown (10YR 5/3) dry; moderate fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine and few coarse roots; many very fine and fine tubular pores; about 15 percent gravel and 5 percent cobbles; slightly acid (pH 6.4); gradual smooth boundary.

Bw2—22 to 29 inches; dark brown (10YR 3/3) gravelly clay loam, brown (10YR 5/3) dry; moderate fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine and few coarse roots; many very fine and fine tubular pores; about 15 percent gravel and 5 percent cobbles; slightly acid (pH 6.2); abrupt wavy boundary.

2R—29 inches; fractured andesite.

The depth to bedrock is 20 to 40 inches. The mollic epipedon is 20 or more inches thick. Reaction is slightly acid or neutral throughout the solum. Hue is 10YR and 7.5YR.

The A horizon has value of 2 or 3 when moist and 4 or 5 when dry and has chroma of 2 or 3 when moist or dry. It has 10 to 20 percent stones, 10 to 15 percent cobbles, and 5 to 15 percent gravel.

The Bw horizon has value of 2 to 4 when moist and 4 or 5 when dry and has chroma of 2 to 4 when moist or dry. It is loam, clay loam, or silty clay loam having 20 to 30 percent clay, 10 to 15 percent gravel, and 0 to 15 percent cobbles.

Morningstar Series

The Morningstar series consists of deep, well drained soils on mountains. These soils formed in colluvium derived from argillite and rhyolitic tuff. Slope is 12 to 60 percent. Elevation is 4,000 to 5,700 feet. The average annual precipitation is 16 to 30 inches, the average annual temperature is 40 to 45 degrees F, and the average frost-free period is 50 to 90 days.

Typical pedon of Morningstar extremely gravelly loam, in an area of Hudspeth-Morningstar complex, 35 to 60 percent south slopes, NE¼SW¼SE¼ sec. 18, T. 11 S., R. 37 E.

Oi—1 inch to 0; partially decomposed needles, leaves, and twigs.

A1—0 to 6 inches; very dark grayish brown (10YR 3/2) extremely gravelly loam, dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure; soft, friable, nonsticky and nonplastic; many very fine and fine and few medium and coarse roots; many very fine and fine tubular pores; about 60 percent gravel and 5 percent cobbles; neutral (pH 6.8); clear smooth boundary.

A2—6 to 15 inches; dark brown (10YR 3/3) extremely gravelly clay loam, brown (10YR 5/3) dry; moderate fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine and few medium and coarse roots; many very fine and fine tubular pores; about 60 percent gravel and 5 percent cobbles; neutral (pH 7.0); clear smooth boundary.

Bt1—15 to 23 inches; brown (10YR 4/3) extremely gravelly clay loam, yellowish brown (10YR 5/4) dry; moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and few medium and coarse roots; many fine tubular pores; common faint clay films on faces of peds; about 60 percent gravel and 5 percent cobbles; neutral (pH 7.2); clear smooth boundary.

Bt2—23 to 32 inches; dark yellowish brown (10YR 4/4) extremely gravelly sandy clay loam, yellowish brown (10YR 5/4) dry; moderate medium subangular blocky structure; hard, firm, sticky and plastic; common fine and few medium and coarse roots; few fine tubular pores; many distinct clay films on faces of peds and lining pores; about 55 percent gravel and 10 percent cobbles; neutral (pH 7.2); abrupt wavy boundary.

Bt3—32 to 46 inches; dark yellowish brown (10YR 4/4) extremely gravelly sandy clay loam, yellowish brown (10YR 5/4) dry; moderate medium and coarse subangular blocky structure; hard, firm, sticky and plastic; few medium and coarse roots; few fine tubular pores; many prominent clay films on faces of peds and lining pores; about 60 percent gravel and 5 percent cobbles; neutral (pH 7.2); gradual smooth boundary.

C—46 to 60 inches; brown (10YR 5/3) extremely gravelly sandy clay loam, pale brown (10YR 6/3) dry; massive; slightly hard, friable, slightly sticky and slightly plastic; few medium and coarse roots; common fine tubular pores; about 60 percent gravel and 5 percent cobbles; neutral (pH 7.2).

The depth to bedrock is typically more than 60 inches but is 40 to 60 inches in some pedons. The mollic epipedon is 10 to 20 inches thick. Reaction is slightly acid or neutral throughout the profile.

The A1 horizon has value of 2 or 3 when moist and 3 or 4 when dry and has chroma of 2 or 3 when moist or dry. It has 55 to 65 percent gravel and 5 to 10 percent cobbles.

The A2 and Bt horizons have value of 3 or 4 when moist and 4 or 5 when dry and have chroma of 3 or 4 when moist or dry. They are sandy clay loam, clay loam, or loam having 25 to 35 percent clay, 50 to 60 percent gravel, and 5 to 20 percent cobbles.

The C horizon has value of 5 or 6 when moist and 6 or 7 when dry and has chroma of 3 or 4 when moist or dry. It is sandy clay loam, loam, or sandy loam having 15 to 25 percent clay, 50 to 60 percent gravel, and 5 to 20 percent cobbles or stones.

Nagle Series

The Nagle series consists of deep, well drained soils on north slopes of dissected terraces. These soils formed in mixed alluvium that is influenced by loess and volcanic ash in the surface layer. Slope is 12 to 50 percent. Elevation is 3,000 to 4,500 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 42 to 45 degrees F, and the average frost-free period is 80 to 110 days.

Typical pedon of Nagle silt loam, 12 to 35 percent north slopes, 1,320 feet east of the southwest corner of sec. 11, T. 10 S., R. 40 E.

A1—0 to 4 inches; very dark brown (10YR 2/2) silt loam, dark grayish brown (10YR 4/2) dry; weak fine and very fine granular structure; soft, friable, slightly sticky and slightly plastic; many very fine and fine roots; many fine and very fine irregular pores; neutral (pH 7.0); clear smooth boundary.

A2—4 to 11 inches; very dark brown (10YR 2/2) silt loam, dark grayish brown (10YR 4/2) dry; weak fine and medium granular structure; soft, friable, slightly sticky and slightly plastic; many very fine and fine roots; many fine and very fine irregular pores; neutral (pH 7.2); gradual smooth boundary.

A3—11 to 18 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak fine and medium granular structure; soft, friable, slightly sticky and slightly plastic; many very fine and fine roots; many fine and very fine irregular pores; mildly alkaline (pH 7.6); gradual wavy boundary.

Bt—18 to 22 inches; very dark grayish brown (10YR 3/2) silty clay loam, grayish brown (10YR 5/2) dry; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine roots; many fine and very fine tubular pores; few faint clay films on faces of peds and in pores; moderately alkaline (pH 8.4); clear wavy boundary.

Btk—22 to 34 inches; dark brown (10YR 3/3) silty clay loam, brown (10YR 5/3) dry; moderate medium subangular blocky structure; hard, friable, sticky and plastic; common fine roots; many very fine tubular pores; few faint clay films on faces of peds and in pores; calcareous coatings on faces of peds and in pores; about 10 percent gravel; strongly alkaline (pH 8.6); gradual wavy boundary.

2Bk—34 to 60 inches; brown (10YR 4/3) gravelly silty clay loam, pale brown (10YR 6/3) dry; massive; hard, friable, sticky and plastic; few fine roots; common fine and medium tubular pores; calcareous coatings on faces of peds and in pores; about 25 percent gravel; strongly alkaline (pH 8.8).

The depth to bedrock is more than 60 inches. The mollic epipedon is 20 to 35 inches thick. The depth to secondary lime is 17 to 22 inches.

The A horizon has value of 4 or 5 when dry and 2 or 3 when moist and has chroma of 2 or 3 when moist or dry. Reaction is neutral or mildly alkaline.

The Bt horizon has value of 5 or 6 when dry and 3 or 4 when moist and has chroma of 2 or 3 when moist or dry. Clay films are few to continuous. Reaction is moderately alkaline or strongly alkaline.

The 2Bk horizon has value of 4 or 5 when moist and 5 or 6 when dry and has chroma of 2 or 3 when moist or dry. It is silty clay loam or clay loam having 15 to 35 percent gravel.

North Powder Series

The North Powder series consists of moderately deep, well drained soils on hills. These soils formed in colluvium derived from quartz diorite and related granitic rocks. Slope is 2 to 35 percent. Elevation is 3,000 to 3,800 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 110 to 130 days.

Typical pedon of North Powder loam, 2 to 12 percent slopes, about 3 miles northeast of Haines, 40 feet south, 70 feet east of the northwest corner of sec. 21, T. 7 S., R. 39 E.

A1—0 to 4 inches; dark grayish brown (10YR 3/2) loam, very light brownish gray (10YR 6/2) dry; weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; many very fine roots; many very fine pores; slightly acid (pH 6.2); clear smooth boundary.

A2—4 to 8 inches; dark grayish brown (10YR 3/2) loam, very light brownish gray (10YR 6/2) dry; weak fine subangular blocky structure; soft, friable, slightly sticky and slightly plastic; many very fine roots; many very fine tubular pores; slightly acid (pH 6.4); clear smooth boundary.

BA—8 to 12 inches; dark brown (10YR 3/3) loam, pale brown (10YR 6/3) dry; weak fine subangular blocky structure; soft, friable, slightly sticky and slightly plastic; many very fine roots; many fine tubular pores; neutral (pH 6.6); clear smooth boundary.

2Bw1—12 to 18 inches; dark brown (10YR 3/3) clay loam, brown (10YR 5/3) dry; moderate medium prismatic structure parting to moderate medium subangular blocky; slightly hard, friable, sticky and plastic; few roots; few fine pores; neutral (pH 7.0); gradual smooth boundary.

2Bw2—18 to 22 inches; dark brown (10YR 4/3) clay loam, brown (10YR 5/3) dry; massive; hard, firm, sticky and plastic; few fine roots; few fine tubular pores; mildly alkaline (pH 7.4); gradual smooth boundary.

2Bk—22 to 28 inches; dark brown (10YR 4/3) loam, pale brown (10YR 6/3) dry; massive; hard, firm, slightly sticky and slightly plastic; few fine roots; few fine tubular pores; moderately alkaline (pH 8.4); fine mycelia of lime, strongly effervescent; abrupt wavy boundary.

3Cr—28 inches; partially weathered quartz diorite.

The depth to weathered bedrock is 20 to 40 inches.

The A and BA horizons have value of 3 or 4 when moist and 5 or 6 when dry and have chroma of 2 or 3 when moist or dry. They have 0 to 10 percent gravel.

The 2Bw1 horizon has value of 3 or 4 when moist and 5 or 6 when dry and has chroma of 3 or 4 when moist or dry. It is clay loam, loam, or sandy clay loam having 18 to 35 percent clay and 0 to 10 percent gravel.

The 2Bw2 and 2Bk horizons have value of 4 or 5 when moist and 5 to 7 when dry and have chroma of 2 or 3 when moist or dry. They are loam, clay loam, or sandy clay loam having 10 to 15 percent gravel.

Oxman Series

The Oxman series consists of moderately deep, well drained soils on dissected fan terraces. These soils formed in lacustrine sediments. Slope is 2 to 35 percent. Elevation is 2,600 to 3,500 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 110 to 130 days.

Typical pedon of Oxman silt loam, 2 to 12 percent slopes, about 1 mile southeast of Durkee, SW¼NE¼ sec. 28, T. 11 S., R. 43 E.

A—0 to 4 inches; dark brown (10YR 3/3) silt loam, pale brown (10YR 6/3) dry; moderate fine and medium granular structure parting to weak very thin platy; soft, very friable, slightly sticky and slightly plastic; many very fine roots; many very fine tubular and irregular pores; moderately alkaline (pH 8.0); strongly effervescent; abrupt wavy boundary.

Bk—4 to 11 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; moderate coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; many very fine tubular pores; slightly effervescent; mildly alkaline (pH 7.8); abrupt wavy boundary.

2Bk1—11 to 21 inches; brown (10YR 4/3) silt loam, very pale brown (10YR 7/3) dry; moderate coarse subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; few very fine roots; common very fine tubular pores; violently effervescent; moderately alkaline (pH 8.2); gradual wavy boundary.

2Bk2—21 to 29 inches; dark yellowish brown (10YR 4/4) silt loam, very pale brown (10YR 7/3) dry; moderate medium and coarse subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; few very fine roots; few very fine tubular pores; about 20 percent soft gravel size lacustrine sediments fragments; violently effervescent; moderately alkaline (pH 8.0); clear wavy boundary.

2Cr—29 inches; light gray (10YR 7/1) platy lacustrine sediment; can be dug with a spade but with difficulty.

The depth to consolidated lacustrine sediments is 20 to 40 inches.

The A horizon has value of 3 or 4 when moist and 5 or 6 when dry and has chroma of 2 or 3 when moist or dry. Reaction is neutral to moderately alkaline.

The Bk horizon has value of 3 or 4 when moist and chroma of 2 to 4 when moist. It is silt loam or silty clay loam. The content of clay is 20 to 35 percent.

The 2Bk horizon has value of 4 or 5 when moist and 6 or 7 when dry and has chroma of 3 or 4 when moist. It is silt loam or very fine sandy loam. Reaction is mildly alkaline or moderately alkaline.

Piersonte Series

The Piersonte series consists of deep, well drained soils on mountains. These soils formed in colluvium derived from schist. Slope is 35 to 70 percent. Elevation is 3,500 to 5,500 feet. The average annual precipitation is 20 to 30 inches, the average annual temperature is 40 to 45 degrees F, and the average frost-free period is 30 to 60 days.

Typical pedon of Piersonte very channery loam, 50 to 70 percent north slopes, NW¼SW¼SW¼ sec. 31, T. 11 S., R. 41 E.

Oi—1 inch to 0; partially decomposed litter of needles, leaves, and twigs.

A1—0 to 4 inches; black (10YR 2/1) very channery loam, very dark brown (10YR 2/2) dry; weak very fine granular structure; loose, very friable, nonsticky and nonplastic; many very fine and fine roots; many very fine and fine irregular pores; about 50 percent channers and 5 percent flagstones; neutral (pH 7.2); clear smooth boundary.

A2—4 to 15 inches; black (10YR 2/1) very channery loam, very dark brown (10YR 2/2) dry; weak very fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine and fine and few medium roots; many very fine and fine irregular pores; about 50 percent channers and 5 percent flagstones; neutral (pH 7.2); gradual smooth boundary.

BA—15 to 27 inches; black (10YR 2/1) extremely channery loam, very dark brown (10YR 2/2) dry; weak fine subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine and fine and few medium roots; many very fine and fine irregular pores; about 55 percent channers and 5 percent flagstones; neutral (pH 6.8); gradual smooth boundary.

Bw—27 to 43 inches; very dark gray (10YR 3/1) extremely channery clay loam, dark gray (10YR 4/1) dry; moderate fine subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine and fine and few medium roots; many very fine and fine irregular pores; about 55 percent channers and 10 percent flagstones; neutral (pH 6.6); gradual smooth boundary.

C—43 to 60 inches; dark grayish brown (10YR 4/2) extremely channery loam, grayish brown (10YR 5/2) dry; moderate fine subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; common fine and few medium roots; many very fine and fine irregular pores; about 60 percent channers and 10 percent flagstones; neutral (pH 6.6).

The depth to bedrock is more than 60 inches. The mollic epipedon is 20 to 30 inches thick. Reaction is neutral or slightly acid throughout the profile.

The A horizon has value of 2 or 3 when moist or dry and has chroma of 1 or 2 when moist or dry. It has 30 to 50 percent channers and 5 to 10 percent flagstones.

The Bw horizon has value of 2 or 3 when moist and 2 to 4 when dry and has chroma of 1 to 3 when moist or dry. It is loam or clay loam having 20 to 30 percent clay, 40 to 60 percent channers, and 10 to 15 percent flagstones.

The C horizon has value of 3 or 4 when moist and 4 to 6 when dry and has chroma of 2 to 4 when moist or dry. It is sandy clay loam or clay loam having 50 to 70 percent channers and 0 to 10 percent flagstones.

Poall Series

The Poall series consists of deep, well drained soils on hills. These soils formed in lacustrine sediments. Slope is 2 to 40 percent. Elevation is 2,200 to 3,600 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 48 to 52 degrees F, and the average frost-free period is 110 to 140 days.

Typical pedon of Poall very fine sandy loam, 12 to 40 percent south slopes, 2 miles south of Huntington, 120 feet east of dirt road, SW¼NW¼ sec. 30, T. 14 S., R. 45 E.

A1—0 to 3 inches; dark brown (10YR 3/3) very fine sandy loam, brown (10YR 5/3) dry; weak fine granular structure; soft, friable, nonsticky and nonplastic; many very fine roots; many very fine irregular pores; mildly alkaline (pH 7.8); abrupt wavy boundary.

A2—3 to 9 inches; brown (10YR 4/3) very fine sandy loam, pale brown (10YR 6/3) dry; moderate medium subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; common fine roots; many very fine tubular pores; mildly alkaline (pH 7.8); abrupt wavy boundary.

2Bt1—9 to 15 inches; dark brown (10YR 3/3) clay, brown (10YR 5/3) dry; strong fine and medium prismatic structure parting to strong fine and medium angular blocky; hard, firm, slightly sticky and plastic; few fine roots; many very fine tubular pores; common faint clay films on faces of peds and in pores; moderately alkaline (pH 8.0); gradual wavy boundary.

2Bt2—15 to 25 inches; dark brown (10YR 3/3) silty clay loam, brown (10YR 5/3) dry; moderate medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few fine roots; many very fine tubular pores; common faint clay films on faces of peds and in pores; moderately alkaline (pH 8.0); gradual wavy boundary.

3Bk1—25 to 41 inches; dark yellowish brown (10YR 4/4) very fine sandy loam, light yellowish brown (10YR 6/4) dry; weak fine and medium subangular blocky structure; hard, firm, nonsticky and nonplastic; slightly effervescent; moderately alkaline (pH 8.2); gradual wavy boundary.

3Bk2—41 to 60 inches; yellowish brown (10YR 5/4) very fine sandy loam, very pale brown (10YR 7/4) dry; massive; soft, friable, nonsticky and nonplastic; strongly effervescent; moderately alkaline (pH 8.4).

The depth to bedrock is more than 60 inches. The thickness of the solum and the depth to carbonates are 15 to 30 inches.

The A horizon has value of 3 or 4 when moist and 5 or 6 when dry and has chroma of 2 or 3 when moist or dry. It is mildly alkaline or moderately alkaline.

The 2Bt horizon has value of 3 or 4 when moist and has chroma of 3 or 4 when moist or dry. It is clay or silty clay loam having 35 to 50 percent clay.

The 3Bk horizon has value of 4 to 6 when moist and 6 or 7 when dry and has chroma of 3 or 4 when moist or dry. It is very fine sandy loam, fine sandy loam, or silt loam. Reaction is moderately alkaline or strongly alkaline.

Powval Series

The Powval series consists of deep, well drained soils on low terraces. These soils formed in mixed alluvium. Slope is 0 to 3 percent. Elevation is 2,200 to 3,500 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 110 to 140 days.

Typical pedon of Powval silt loam, 0 to 3 percent slopes, in Baker, 350 feet north and 40 feet east of the intersection of Pocahontas Road and 17th Street, SW¼NW¼ sec. 8, T. 9 S., R. 40 E.

Apk—0 to 9 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; common very fine irregular pores; strongly effervescent; moderately alkaline (pH 8.2); abrupt smooth boundary.

Ak—9 to 13 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; common very fine tubular pores; strongly effervescent; moderately alkaline (pH 8.2); clear smooth boundary.

Bk1—13 to 32 inches; dark brown (10YR 3/3) coarse silt loam, grayish brown (10YR 5/2) dry; weak coarse prismatic and weak coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; common very fine tubular pores; strongly effervescent; strongly alkaline (pH 8.6); abrupt smooth boundary.

Bk2—32 to 41 inches; very dark grayish brown (10YR 3/2) coarse silt loam, grayish brown (10YR 5/2) dry; massive; hard, firm, nonsticky and nonplastic; common very fine roots; common very fine tubular pores; slightly effervescent; moderately alkaline (pH 8.2); clear smooth boundary.

Bk3—41 to 56 inches; dark grayish brown (10YR 4/2) silt loam, grayish brown (10YR 5/2) dry; many fine distinct dark reddish brown (5YR 3/4) mottles; massive; hard, firm, nonsticky and nonplastic; common very fine roots; common very fine tubular pores; very slightly effervescent; moderately alkaline (pH 8.2); clear smooth boundary.

C—56 to 100 inches; dark gray (10YR 4/1) silt loam, grayish brown (10YR 5/2) dry; many fine distinct dark reddish brown (5YR 3/4) mottles; massive; slightly hard, friable, nonsticky and nonplastic; few very fine roots in the upper part; many very fine and fine tubular pores; mildly alkaline (pH 7.8).

The depth to bedrock is more than 60 inches. The mollic epipedon is more than 20 inches thick. Reaction is mildly alkaline or moderately alkaline throughout the profile.

The Ak horizon has value of 2 or 3 when moist and 4 or 5 when dry and has chroma of 2 or 3 when moist or dry.

The Bk1 horizon has value of 2 or 3 when moist and 4 or 5 when dry and has chroma of 2 or 3 when moist or dry. It is silt loam or very fine sandy loam. It has medium or coarse prismatic or fine to coarse subangular blocky structure.

The Bk2 and Bk3 horizons have value of 3 or 4 when moist and 5 or 6 when dry and have chroma of 2 or 3 when moist or dry. They are silt loam or very fine sandy loam. In some pedons the Bk3 horizon has no mottles.

The C horizon has value of 3 or 4 when moist and 5 or 6 when dry and has chroma of 1 to 3 when moist or dry. It is very fine sandy loam or silt loam having 0 to 20 percent gravel.

Pritchard Series

The Pritchard series consists of deep, well drained soils on hills. These soils formed in loess and in colluvium derived from gabbro. Slope is 2 to 20 percent. Elevation is 3,200 to 3,700 feet. The average annual precipitation is 12 to 16 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 110 to 130 days.

Typical pedon of Pritchard silty clay loam, 2 to 7 percent slopes, 900 feet east and 400 feet north of the southwest corner of sec. 21, T. 9 S., R. 43 E.

A1—0 to 3 inches; very dark gray (10YR 3/1) silty clay loam, dark grayish brown (10YR 4/2) dry; weak very fine and fine subangular blocky structure parting to fine moderate granular; hard, firm, sticky and plastic; common very fine roots; few very fine tubular pores; neutral (pH 7.0); clear smooth boundary.

A2—3 to 12 inches; very dark grayish brown (10YR 3/2) silty clay loam, grayish brown (10YR 5/2) dry;

moderate medium and coarse subangular blocky structure; hard, firm, sticky and plastic; few very fine roots; few very fine tubular pores; neutral (pH 7.2); abrupt smooth boundary.

2Bt—12 to 28 inches; very dark grayish brown (10YR 3/2) clay, dark grayish brown (10YR 4/2) dry; strong coarse subangular blocky structure; very hard, very firm, very sticky and very plastic; few very fine roots; few very fine tubular pores; many prominent clay films on faces of peds and lining pores; neutral (pH 7.2); clear smooth boundary.

2Btk—28 to 38 inches; dark brown (10YR 4/3) silty clay, yellowish brown (10YR 5/4) dry; strong medium subangular blocky structure; very hard, very firm, very sticky and very plastic; few faint clay films on faces of peds; slightly effervescent; mildly alkaline (pH 7.6); clear smooth boundary.

2BC—38 to 52 inches; dark yellowish brown (10YR 4/4) silty clay, yellowish brown (10YR 5/4) dry; moderate fine and medium subangular blocky structure; hard, firm, sticky and plastic; mildly alkaline (pH 7.6); clear smooth boundary.

2C—52 to 68 inches; yellowish brown (10YR 5/4) clay loam, yellowish brown (10YR 5/6) dry; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; mildly alkaline (pH 7.6).

The depth to bedrock is typically more than 60 inches but is 40 to 60 inches in some pedons. Depth to the 2Bt horizon is 10 to 20 inches.

The A horizon has value of 2 or 3 when moist and 4 or 5 when dry and has chroma of 1 or 2 when moist or dry. It has 0 to 10 percent gravel and 0 to 5 percent cobbles.

The 2Bt horizon has value of 3 or 4 when moist and 4 or 5 when dry and has chroma of 2 to 4 when moist or dry. It is silty clay or clay. It is slightly effervescent in the lower part in most pedons.

The 2C horizon has value of 4 or 5 when moist or dry and has chroma of 3 or 4 when moist and 4 to 6 when dry. It is clay loam or silty clay loam having 0 to 15 percent gravel and 0 to 5 percent cobbles.

Rastus Series

The Rastus series consists of well drained soils on terraces. These soils are moderately deep to a duripan. They formed in mixed alluvium. Slope is 1 to 7 percent. Elevation is 4,000 to 4,700 feet. The average annual precipitation is 12 to 16 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 60 to 90 days.

Typical pedon of Rastus very gravelly loam, 1 to 7 percent slopes, about 1,700 feet north and 2,000 feet east of the southwest corner of sec. 27, T. 13 S., R. 37 E.

A1—0 to 4 inches; very dark grayish brown (10YR 3/2) very gravelly loam, grayish brown (10YR 5/2) dry; moderate fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine and fine tubular pores; about 40 percent gravel; neutral (pH 6.8); clear smooth boundary.

A2—4 to 12 inches; very dark grayish brown (10YR 3/2) gravelly clay loam, grayish brown (10YR 5/2) dry; moderate fine granular structure; hard, firm, sticky and plastic; common very fine and fine roots; common very fine and fine tubular pores; about 20 percent gravel; neutral (pH 7.0); abrupt smooth boundary.

2Bt—12 to 19 inches; dark yellowish brown (10YR 4/4) clay, dark yellowish brown (10YR 4/4) dry; strong very coarse angular blocky structure; very hard, very firm, very sticky and very plastic; few very fine and fine roots; few very fine and fine tubular pores; many prominent clay films on faces of peds and lining pores; about 10 percent gravel; neutral (pH 7.2); clear smooth boundary.

2Btk—19 to 24 inches; dark yellowish brown (10YR 4/4) gravelly clay, dark yellowish brown (10YR 4/6) dry; strong medium subangular blocky structure; hard, firm, sticky and plastic; few fine roots; few fine tubular pores; many prominent clay films on faces of peds and lining pores; about 25 percent gravel; strongly effervescent; mildly alkaline (pH 7.8); abrupt wavy boundary.

2Bkqm—24 to 37 inches; brownish yellow (10YR 6/6), indurated duripan, very pale brown (10YR 8/3) dry; massive; very hard; violently effervescent; strongly alkaline (pH 8.6); abrupt wavy boundary.

3C—37 to 60 inches; multicolored extremely gravelly sandy loam; massive; about 70 percent gravel; mildly alkaline (pH 7.6).

The depth to bedrock is more than 60 inches. Depth to the duripan is 20 to 30 inches. Depth to the 2Bt horizon is 10 to 15 inches.

The A1 horizon has value of 2 or 3 when moist and 4 or 5 when dry and has chroma of 2 or 3 when moist or dry. It has 35 to 50 percent gravel and 0 to 10 percent cobbles. The A2 horizon has similar colors and is 0 to 30 percent gravel.

The 2Bt horizon has value of 3 or 4 when moist and 4 or 5 when dry and has chroma of 3 or 4 when moist and 4 or 5 when dry. It has 50 to 60 percent clay and 0 to 10 percent gravel.

The 2Btk horizon has value of 3 or 4 when moist and 4 or 5 when dry and has chroma of 3 or 4 when moist and 4 to 6 when dry. It is clay having 50 to 60 percent clay and 20 to 30 percent gravel. It is slightly effervescent to violently effervescent. Some pedons do not have a 2Btk horizon.

The 2Bkqm horizon is indurated throughout or is indurated in the upper few inches and strongly cemented in the lower part. It is strongly effervescent or violently effervescent.

The 3C horizon is sandy loam or loamy sand having 35 to 60 percent gravel and 10 to 20 percent cobbles. It is neutral or mildly alkaline.

Redcliff Series

The Redcliff series consists of moderately deep, well drained soils on hills. These soils formed in colluvium derived from metavolcanic rock. Slope is 30 to 75 percent. Elevation is 2,000 to 3,600 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 46 to 48 degrees F, and the average frost-free period is 90 to 120 days.

Typical pedon of Redcliff gravelly loam, 50 to 75 percent north slopes, about 200 feet from the railroad tracks along the Burnt River, 0.25 mile west of the Snake River, SE¼SE¼ sec. 8, T. 14 S., R. 45 E.

A1—0 to 4 inches; very dark grayish brown (10YR 3/2) gravelly loam, dark grayish brown (10YR 4/2) dry; moderate very fine and fine granular structure; loose, very friable, slightly sticky and slightly plastic; many very fine and fine roots; common very fine irregular pores; about 25 percent gravel; mildly alkaline (pH 7.6); gradual wavy boundary.

A2—4 to 8 inches; very dark grayish brown (10YR 3/2) gravelly loam, brown (10YR 4/3) dry; weak fine subangular blocky structure parting to weak fine granular; soft, very friable, slightly sticky and slightly plastic; common very fine and fine roots; common very fine irregular pores; about 15 percent gravel; mildly alkaline (pH 7.6); gradual wavy boundary.

Bw1—8 to 14 inches; dark brown (10YR 3/3) gravelly sandy clay loam, dark yellowish brown (10YR 4/4) dry; moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; common very fine tubular pores; about 25 percent gravel; mildly alkaline (pH 7.6); gradual wavy boundary.

Bw2—14 to 22 inches; dark yellowish brown (10YR 3/4) very gravelly sandy clay loam, yellowish brown (10YR 5/4) dry; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few medium roots; many very fine and fine tubular pores; about 30 percent gravel and 10 percent cobbles; mildly alkaline (pH 7.8); gradual wavy boundary.

Bw3—22 to 31 inches; dark yellowish brown (10YR 4/4) very gravelly sandy loam, yellowish brown (10YR 5/4) dry; weak medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few fine roots; common very fine and fine tubular pores; about 30 percent gravel and 15 percent cobbles; mildly alkaline (pH 7.8); abrupt wavy boundary.

R—31 inches; fractured bedrock.

The depth to bedrock is 20 to 40 inches.

The A horizon has value of 4 or 5 when dry and has chroma of 2 or 3 when moist or dry. It has 15 to 35 percent gravel and 0 to 5 percent cobbles.

The Bw1 and Bw2 horizons have value of 3 or 4 when moist and 4 or 5 when dry and have chroma of 2 to 4 when moist or dry. They have 20 to 40 percent gravel and 5 to 20 percent cobbles.

The Bw3 horizon has value of 4 or 5 when moist and 5 or 6 when dry and has chroma of 4 to 6 when moist or dry. It is sandy loam or sandy clay loam having 15 to 30 percent clay, 25 to 40 percent gravel, and 5 to 20 percent cobbles. Reaction is mildly alkaline or moderately alkaline.

Ridley Series

The Ridley series consists of deep, well drained soils on hills. These soils formed in colluvium derived from greenstone and influenced by loess and volcanic ash in the surface layer. Slope is 2 to 12 percent. Elevation is 3,000 to 3,800 feet. The average annual precipitation is 12 to 16 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 130 days.

Typical pedon of Ridley silt loam, in an area of Ridley-Keating silt loams, 2 to 12 percent slopes, 1,000 feet south and 350 feet east of the northwest corner of sec. 2, T. 8 S., R. 42 E.

A1—0 to 4 inches; very dark brown (10YR 2/2) silt loam, brown (10YR 5/3) dry; weak fine and medium subangular blocky structure parting to moderate fine granular; soft, friable, nonsticky and nonplastic; many very fine and fine roots; many very fine and fine tubular pores; neutral (pH 6.8); clear smooth boundary.

A2—4 to 9 inches; very dark brown (10YR 2/2) silt loam, brown (10YR 5/3) dry; moderate fine and medium subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; common very fine and fine roots; few very fine and fine tubular pores; neutral (pH 7.0); clear smooth boundary.

Bw1—9 to 14 inches; very dark grayish brown (10YR

3/2) silty clay loam, brown (10YR 5/3) dry; strong medium and coarse subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; few very fine and fine roots; few very fine and fine tubular pores; neutral (pH 7.0); clear smooth boundary.

Bw2—14 to 24 inches; dark brown (10YR 3/3) silty clay loam, brown (10YR 5/3) dry; strong medium and coarse subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; few very fine and fine roots; few very fine and fine tubular pores; neutral (pH 7.2); abrupt smooth boundary.

2Bt1—24 to 33 inches; dark brown (10YR 3/3) clay, brown (10YR 4/3) dry; strong coarse and very coarse subangular blocky structure; hard, very firm, sticky and plastic; many prominent clay films on faces of peds and lining pores; mildly alkaline (pH 7.4); clear smooth boundary.

2Bt2—33 to 42 inches; dark brown (10YR 4/3) silty clay, brown (10YR 5/3); moderate medium and coarse subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; common distinct clay films on faces of peds and lining pores; mildly alkaline (pH 7.6); clear smooth boundary.

3Bk—42 to 68 inches; dark brown (10YR 4/3) silty clay loam, yellowish brown (10YR 5/4) dry; moderate fine and medium subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; strongly effervescent, lime segregated in common fine irregularly shaped seams; moderately alkaline (pH 8.2).

The depth to bedrock is typically more than 60 inches but is 40 to 60 inches in some pedons. Depth to the 2Bt horizon is 20 to 40 inches. Hue is 10YR or 7.5YR.

The A horizon has value of 2 or 3 when moist and 4 or 5 when dry and has chroma of 1 to 3 when moist or dry.

The Bw horizon has value of 2 or 3 when moist and 4 or 5 when dry and has chroma of 2 or 3 when moist or dry. It is silt loam or silty clay loam having 20 to 40 percent clay.

The 2Bt horizon has value of 3 or 4 when moist and 4 or 5 when dry and has chroma of 3 or 4 when moist or dry. It is clay or silty clay having 50 to 60 percent clay.

The 3Bk horizon has value of 5 or 6 when dry and has chroma of 3 or 4 when moist or dry. It has 0 to 15 percent gravel. It is slightly effervescent to strongly effervescent. Some pedons do not have a 3Bk horizon.

Robinette Series

The Robinette series consists of deep, well drained soils on hills. These soils formed in colluvium derived from basalt and influenced by loess in the surface layer. Slope is 2 to 12 percent. Elevation is 2,500 to 4,000 feet. The average annual precipitation is 14 to 20 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 120 days.

Typical pedon of Robinette silt loam, in an area of Robinette-Gwinly complex, 2 to 12 percent slopes, 225 feet north and 200 feet east of the southwest corner of sec. 28, T. 8 S., R. 47 E.

A1—0 to 3 inches; very dark brown (10YR 2/2) silt loam, dark grayish brown (10YR 4/2) dry; weak fine and very fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine and fine roots; common very fine and fine tubular pores; neutral (pH 6.8); clear smooth boundary.

A2—3 to 13 inches; very dark brown (10YR 2/2) silt loam, dark grayish brown (10YR 4/2) dry; moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; common very fine and fine tubular pores; neutral (pH 6.8); clear smooth boundary.

Bw—13 to 29 inches; dark brown (10YR 3/3) silty clay loam, brown (10YR 4/3) dry; moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; common very fine tubular pores; neutral (pH 6.8); gradual wavy boundary.

Bt1—29 to 44 inches; dark brown (10YR 3/3) silty clay loam, brown (10YR 4/3) dry; moderate medium and coarse subangular blocky structure; hard, firm, sticky and plastic; common very fine roots; common very fine tubular pores; many distinct clay films on faces of peds and lining pores; neutral (pH 6.8); gradual wavy boundary.

2Bt2—44 to 53 inches; brown (7.5YR 4/4) extremely cobbly clay, strong brown (7.5YR 5/6) dry; moderate medium and coarse subangular blocky structure; hard, firm, sticky and plastic; few very fine roots; few very fine irregular pores; continuous prominent clay films on faces of peds and lining pores; about 25 percent gravel and 50 percent cobbles; neutral (pH 7.0); gradual irregular boundary.

2R—53 inches; basalt.

The depth to bedrock is 40 to 60 inches. Hue is 10YR to 5YR.

The A horizon has value of 2 or 3 when moist and 4 or 5 when dry and has chroma of 2 to 4 when moist or dry. It has 0 to 10 percent gravel.

The Bw and Bt1 horizons have value of 2 to 4 when moist and 3 to 5 when dry and have chroma of 2 to 4 when moist and 3 to 6 when dry. They are silty clay loam or clay loam having 0 to 15 percent gravel.

The 2Bt horizon has value of 3 or 4 when moist and 4 or 5 when dry and has chroma of 3 or 4 when moist and 5 or 6 when dry. It has 20 to 30 percent gravel and 40 to 55 percent cobbles.

Rockly Series

The Rockly series consists of very shallow, well drained soils on hills and ridgetops. These soils formed in colluvium derived from basalt and in loess. Slope is 2 to 35 percent. Elevation is 2,500 to 4,000 feet. The average annual precipitation is 14 to 20 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 120 days.

Typical pedon of Rockly very cobbly loam, in an area of Rockly-Gwinly complex, 2 to 12 percent slopes, SW¼SW¼SE¼ sec. 31, T. 8 S., R. 46 E.

A—0 to 2 inches; very dark brown (10YR 2/2) very cobbly loam, brown (10YR 4/3) dry; weak fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine irregular pores; about 15 percent gravel, 35 percent cobbles, and 5 percent stones; neutral (pH 6.8); clear wavy boundary.

Bw1—2 to 5 inches; dark brown (7.5YR 3/2) very cobbly clay loam, brown (7.5YR 4/2) dry; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine and fine tubular pores; about 10 percent gravel and 55 percent cobbles; neutral (pH 6.6); clear wavy boundary.

Bw2—5 to 8 inches; dark brown (7.5YR 3/2) extremely cobbly clay loam, brown (7.5YR 4/2) dry; moderate medium subangular blocky structure; hard, firm, sticky and plastic; many very fine and fine roots; many very fine and fine tubular pores; about 15 percent gravel and 60 percent cobbles; neutral (pH 6.6); abrupt wavy boundary.

2R—8 inches; basalt.

The depth to bedrock is 5 to 10 inches. Hue is 5YR to 10YR. In some pedons a duripan is at a depth of 6 to 12 inches.

The A horizon has value of 2 or 3 when moist and 4 or 5 when dry and has chroma of 2 or 3 when moist or dry. It has 10 to 15 percent gravel, 30 to 40 percent cobbles, and 0 to 5 percent stones.

The Bw horizon has value of 3 or 4 when moist and 4 or 5 when dry and has chroma of 2 to 4 when moist or dry. It is loam or clay loam having 10 to 20 percent gravel and 50 to 60 percent cobbles.

Roostercomb Series

The Roostercomb series consists of moderately deep, well drained soils on the top and side slopes of hills. These soils formed in colluvium derived from greenstone. Slope is 2 to 50 percent. Elevation is 3,800 to 5,700 feet. The average annual precipitation is 12 to 16 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 50 to 90 days.

Typical pedon of Roostercomb extremely gravelly clay loam, in an area of Ateron-Roostercomb extremely gravelly clay loams, 12 to 35 percent south slopes, SE¼NE¼SE¼ sec. 24, T. 12 S., R. 41 E.

A1—0 to 5 inches; dark brown (10YR 3/3) extremely gravelly clay loam, brown (10YR 4/3) dry; moderate very fine and fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine and fine tubular pores; about 50 percent gravel, 10 percent cobbles, and 5 percent stones; neutral (pH 6.6); clear smooth boundary.

A2—5 to 12 inches; dark brown (10YR 3/3) extremely gravelly clay loam, brown (10YR 5/3) dry; moderate fine and medium subangular blocky structure; slightly hard, firm, sticky and plastic; common very fine and fine and few medium roots; many very fine and fine tubular pores; about 60 percent gravel and 5 percent cobbles and stones; neutral (pH 6.8); clear smooth boundary.

Bt1—12 to 25 inches; dark yellowish brown (10YR 4/4) extremely gravelly clay, light yellowish brown (10YR 6/4) dry; moderate medium and coarse subangular blocky structure; hard, firm, sticky and plastic; common very fine and fine and few medium roots; many very fine and fine tubular pores; common distinct clay films on faces of peds and lining pores; about 60 percent gravel and 5 percent cobbles and stones; neutral (pH 7.0); gradual wavy boundary.

Bt2—25 to 36 inches; dark yellowish brown (10YR 4/6) extremely cobbly clay, light yellowish brown (10YR 6/4) dry; moderate coarse subangular blocky structure; very hard, very firm, very sticky and very plastic; few fine roots; common very fine and fine tubular pores; many distinct clay films on faces of peds and lining pores; about 30 percent cobbles, 25 percent gravel, and 10 percent stones; neutral (pH 7.2); gradual wavy boundary.

R—36 inches; highly fractured greenstone.

The depth to bedrock is 20 to 40 inches. The mollic epipedon is 10 to 20 inches thick. Depth to the 2Bt horizon is 10 to 20 inches. Reaction is neutral or mildly alkaline throughout the solum.

The A1 horizon has value of 2 or 3 when moist and 3 to 5 when dry and has chroma of 2 or 3 when moist or dry. It has 40 to 50 percent gravel, 5 to 10 percent cobbles, and 0 to 10 percent stones.

The A2 horizon has value of 3 or 4 when moist and 4 or 5 when dry and has chroma of 2 or 3 when moist or dry. It is clay loam or loam having 40 to 60 percent gravel and 5 to 10 percent cobbles and stones.

The Bt horizon has value of 4 or 5 when moist and 5 or 6 when dry and has chroma of 4 to 6 when moist or dry. It is silty clay or clay having 40 to 50 percent clay, 20 to 60 percent gravel, and 10 to 40 percent cobbles and stones.

Some pedons have a Bk horizon that has value of 5 or 6 when moist and 6 or 7 when dry and has chroma of 3 or 4 when moist or dry. It is loam or clay loam having 20 to 30 percent clay, 10 to 20 percent gravel, and 40 to 60 percent cobbles and stones.

Rouen Series

The Rouen series consists of moderately deep, well drained soils on mountains. These soils formed in colluvium derived from argillite and have a mantle of volcanic ash. Slope is 2 to 50 percent. Elevation is 3,800 to 6,200 feet. The average annual precipitation is 20 to 35 inches, the average annual temperature is 40 to 45 degrees F, and the average frost-free period is 30 to 50 days.

Typical pedon of Rouen gravelly silt loam, in an area of Crackler-Rouen gravelly silt loams, 30 to 50 percent north slopes, SW¼NW¼NW¼ sec. 32, T. 9 S., R. 37 E.

Oi—1 inch to 0; partially decomposed litter of needles, leaves, and twigs.

A1—0 to 3 inches; dark brown (10YR 3/3) gravelly silt loam, pale brown (10YR 6/3) dry; weak very fine subangular blocky structure parting to weak fine granular; soft, very friable, nonsticky and nonplastic; moderately smeary; many very fine and fine and few medium and coarse roots; many very fine and fine irregular pores; about 25 percent gravel; slightly acid (pH 6.2); clear smooth boundary.

A2—3 to 16 inches; dark yellowish brown (10YR 4/4) gravelly silt loam, light yellowish brown (10YR 6/4) dry; weak very fine and fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; moderately smeary; many very fine and fine and few medium and coarse roots; many very fine and fine irregular pores; about 30 percent gravel; slightly acid (pH 6.4); clear smooth boundary.

2Bw1—16 to 23 inches; yellowish brown (10YR 5/4) extremely gravelly silty clay loam, very pale brown (10YR 7/3) dry; moderate fine subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; common fine and few medium and coarse roots; common fine and medium tubular pores; about 60 percent gravel and 5 percent cobbles; neutral (pH 6.6); gradual wavy boundary.

2Bw2—23 to 31 inches; yellowish brown (10YR 5/4) extremely gravelly clay loam, very pale brown (10YR 7/3) dry; moderate fine and medium subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; common fine and few medium and coarse roots; common fine and medium tubular pores; about 60 percent gravel and 10 percent cobbles; neutral (pH 6.6); abrupt wavy boundary.

3R—31 inches; argillite.

The depth to bedrock is 20 to 40 inches. Depth to the 2Bw1 horizon is 14 to 25 inches.

The A1 horizon has value of 2 or 3 when moist and 5 or 6 when dry and has chroma of 2 to 4 when moist or dry. It has 15 to 25 percent gravel and 0 to 5 percent cobbles and stones. Reaction is slightly or moderately acid. This horizon is moderately smeary or weakly smeary.

The A2 horizon has hue of 10YR or 7.5YR, value of 3 or 4 when moist and 4 to 6 when dry, and chroma of 3 or 4 when moist or dry. It has 15 to 30 percent gravel and 0 to 5 percent cobbles. Reaction is slightly acid or neutral. This horizon is moderately smeary or weakly smeary.

The 2Bw horizon has hue of 10YR or 7.5YR, value of 3 to 5 when moist and 4 to 7 when dry, and chroma of 3 or 4 when moist or dry. It is silty clay loam, clay loam, or loam having 25 to 35 percent clay, 30 to 60 percent gravel, and 5 to 10 percent cobbles. Reaction is slightly acid or neutral.

Ruckles Series

The Ruckles series consists of shallow, well drained soils on hills. These soils formed in colluvium derived from basalt and influenced by loess and volcanic ash in the surface layer. Slope is 2 to 70 percent. Elevation is 2,000 to 3,800 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 130 days.

Typical pedon of Ruckles very stony clay loam, in an area of Ruckles-Ruclick complex, 12 to 35 percent south slopes, 300 feet north of the southeast corner of sec. 35, T. 8 S., R. 41 E.

A1—0 to 1 inch; very dark grayish brown (10YR 3/2) very stony clay loam, grayish brown (10YR 5/2) dry; weak thin platy and fine granular structure; soft, friable, slightly sticky and slightly plastic; many very fine and fine roots; few fine tubular pores; about 30 percent stones, 10 percent cobbles, and 5 percent gravel; neutral (pH 6.9); clear smooth boundary.

A2—1 to 5 inches; very dark grayish brown (10YR 3/2) very stony clay loam, grayish brown (10YR 5/2) dry; weak very fine subangular blocky structure; hard, firm, sticky and plastic; many very fine roots; few fine tubular pores; about 25 percent stones, 15 percent cobbles, and 15 percent gravel; neutral (pH 6.8); abrupt wavy boundary.

Bt1—5 to 8 inches; dark brown (10YR 3/3) very stony clay, dark brown (10YR 4/3) dry; moderate fine to medium subangular blocky structure; very hard, very firm, very sticky and very plastic; many very fine roots; few fine tubular pores; continuous prominent clay films on faces of peds and in pores; about 30 percent stones, 15 percent cobbles, and 10 percent gravel; neutral (pH 6.8); clear wavy boundary.

Bt2—8 to 11 inches; dark yellowish brown (10YR 3/4) very stony clay, dark yellowish brown (10YR 4/4) dry; weak medium prismatic structure parting to moderate fine and medium subangular blocky; extremely hard, very firm, very sticky and very plastic; few very fine roots; few fine tubular pores; continuous prominent clay films on faces of peds and in pores; about 35 percent stones, 15 percent cobbles, and 10 percent gravel; mildly alkaline (pH 7.4); clear wavy boundary.

C—11 to 16 inches; dark brown (10YR 4/3) extremely stony sandy clay, brown (10YR 5/3) dry; massive; very hard, firm, sticky and plastic; strongly effervescent; lime on the bottom of rock fragments; about 45 percent stones and 35 percent cobbles; moderately alkaline (pH 8.2); abrupt irregular boundary.

R—16 inches; basalt.

The depth to bedrock is 10 to 20 inches.

The A horizon has value of 2 or 3 when moist and 4 or 5 when dry and has chroma of 2 or 3 when moist or dry. It has 5 to 20 percent gravel, 10 to 25 percent cobbles, and 20 to 35 percent stones.

The Bt horizon has hue of 7.5YR or 10YR, value of 3 or 4 when moist and 4 or 5 when dry and has chroma of 2 to 4 when moist or dry. The content of clay is 50 to 60 percent. This horizon has 5 to 15 percent gravel, 10 to 20 percent cobbles, and 20 to 40 percent stones.

The C horizon is sandy clay or clay having 40 to 50 percent clay, 0 to 20 percent gravel, 20 to 40 percent cobbles, and 20 to 50 percent stones. Reaction is mildly alkaline or moderately alkaline. Segregated carbonates generally are thin coatings on the bottom of cobbles and stones. Some pedons do not have a C horizon.

Ruclick Series

The Ruclick series consists of moderately deep, well drained soils on hills. These soils formed in colluvium derived from basalt and influenced by loess and volcanic ash. Slope is 2 to 70 percent. Elevation is 2,000 to 3,800 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 130 days.

Typical pedon of Ruclick very cobbly silt loam, in an area of Ruckles-Ruclick complex, 35 to 50 percent south slopes, 400 feet north and 150 feet east of the southwest corner of sec. 14, T. 9 S., R. 46 E.

A1—0 to 2 inches; very dark grayish brown (10YR 3/2) very cobbly silt loam, dark brown (10YR 4/3) dry; weak fine granular structure; soft, friable, nonsticky and nonplastic; many very fine and fine roots; many very fine and fine irregular pores; about 25 percent gravel, 15 percent cobbles, and 5 percent stones; neutral (pH 7.2); clear smooth boundary.

A2—2 to 12 inches; dark brown (10YR 3/3) very cobbly silty clay loam, dark brown (10YR 4/3) dry; moderate fine and medium subangular blocky structure; slightly hard, firm, slightly sticky and plastic; common fine roots; common fine tubular pores; about 25 percent gravel and 20 percent cobbles; mildly alkaline (pH 7.4); clear wavy boundary.

Bt1—12 to 20 inches; dark brown (7.5YR 3/2) very cobbly clay, brown (7.5YR 4/4) dry; moderate medium and coarse subangular blocky structure; hard, firm, sticky and plastic; common fine roots; few very fine and fine tubular pores; common faint clay films on faces of peds and lining pores; about 40 percent cobbles and 10 percent gravel; mildly alkaline (pH 7.4); clear wavy boundary.

Bt2—20 to 27 inches; dark brown (7.5YR 3/2) extremely cobbly clay, brown (7.5YR 4/4) dry; strong medium and coarse subangular blocky structure; very hard, very firm, very sticky and very plastic; few very fine and fine roots; few very fine and fine tubular pores; many faint clay films on faces of peds and lining pores; about 60 percent cobbles and 10 percent gravel; neutral (pH 7.2); clear wavy boundary.

Bt3—27 to 34 inches; dark brown (7.5YR 3/2) extremely cobbly clay, dark yellowish brown (10YR 4/4) dry; strong medium and coarse subangular blocky structure; hard, firm, sticky and plastic; few very fine roots; few very fine pores; many faint clay films on faces of peds and lining pores; about 65 percent cobbles and 15 percent gravel; neutral (pH 7.2); abrupt wavy boundary.

R—34 inches; hard basalt.

The depth to bedrock is 20 to 40 inches. Hue is 10YR and 7.5YR.

The A horizon has value of 4 or 5 when dry and 2 or 3 when moist and has chroma of 2 or 3 when moist or dry. It has 10 to 35 percent gravel, 15 to 35 percent cobbles, and 0 to 10 percent stones. The A2 horizon is silty clay loam or clay loam.

The Bt horizon has value and chroma of 3 or 4 when moist or dry. It is silty clay or clay having 10 to 20 percent gravel, 40 to 65 percent cobbles, and 0 to 10 percent stones. Reaction is neutral to moderately alkaline.

Sag Series

The Sag series consists of deep, well drained soils on hills. These soils formed in colluvium derived from basalt and influenced by loess and volcanic ash in the surface layer. Slope is 12 to 70 percent. Elevation is 3,400 to 5,000 feet. The average annual precipitation is 14 to 20 inches, the average annual temperature is 40 to 45 degrees F, and the average frost-free period is 60 to 90 days.

Typical pedon of Sag silt loam, in an area of Sag-Snell complex, 12 to 35 percent north slopes, 1,000 feet west and 600 feet north of the southeast corner of sec. 32, T. 8 S., R. 46 E.

A1—0 to 10 inches; very dark brown (10YR 2/2) silt loam, very dark grayish brown (10YR 3/2) dry; moderate fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine and fine roots; many very fine and fine irregular pores; slightly acid (pH 6.2); clear smooth boundary.

A2—10 to 22 inches; very dark brown (10YR 2/2) silt loam, dark brown (10YR 3/3) dry; moderate fine and medium subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; common very fine and fine roots; many very fine and fine tubular pores; about 5 percent gravel; slightly acid (pH 6.2); clear smooth boundary.

Bt1—22 to 40 inches; dark brown (7.5YR 3/2) silty clay loam, brown (7.5YR 4/2) dry; moderate fine and medium subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; common very fine and fine roots; common very fine and fine tubular pores; common faint clay films on faces of peds; about 5 percent gravel and 5 percent cobbles; slightly acid (pH 6.2); abrupt wavy boundary.

2Bt2—40 to 51 inches; dark brown (7.5YR 4/4) clay, brown (7.5YR 4/4) dry; strong fine and medium subangular very cobbly blocky structure; hard, firm, sticky and plastic; few very fine roots; common very fine tubular pores; many distinct clay films on faces of peds; about 15 percent gravel and 20 percent cobbles; slightly acid (pH 6.4); clear wavy boundary.

2Bt3—51 to 58 inches; dark brown (7.5YR 4/4) extremely cobbly clay, brown (10YR 5/4) dry; moderate fine and medium subangular blocky structure; hard, firm, sticky and plastic; few very fine roots; few very fine tubular pores; common distinct clay films on faces of peds; about 40 percent cobbles and 30 percent gravel; slightly acid (pH 6.4); abrupt wavy boundary.

3R—58 inches; hard basalt

The depth to bedrock is typically 40 to 60 inches. Hue is 10YR or 7.5YR.

The A1 horizon has value of 2 or 3 when moist and 3 or 4 when dry and has chroma of 1 to 3 when moist or dry. It has 0 to 10 percent gravel.

The A2 horizon has value of 2 or 3 when moist and 3 or 4 when dry and has chroma of 2 or 3 when moist or dry. It has 0 to 10 percent gravel and 0 to 5 percent cobbles.

The Bt1 horizon has value of 2 or 3 when moist and 3 or 4 when dry and has chroma of 2 to 4 when moist or dry. It is silty clay loam or clay loam having 5 to 25 percent gravel and 0 to 5 percent cobbles.

The 2Bt horizon has value of 3 or 4 when moist and 4 or 5 when dry and has chroma of 4 or 5 when moist or dry. It is clay loam or clay having 35 to 60 percent clay, 10 to 45 percent gravel, and 0 to 40 percent cobbles.

Segundo Series

The Segundo series consists of deep, well drained soils on mountains. These soils formed in colluvium derived from rhyolite and andesite. Slope is 2 to 75 percent. Elevation is 4,000 to 6,000 feet. The average annual precipitation is 16 to 30 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 60 to 90 days.

Typical pedon of Segundo very gravelly loam, 35 to 50 percent south slopes, about 2 miles east of Dooley Mountain summit, in the center of SW¼NW¼SE¼ sec. 34, T. 11 S., R. 40 E.

Oi—1 inch to 0; partially decomposed pine needles, grass, and twigs.

A—0 to 5 inches; very dark brown (10YR 2/2) very gravelly loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; slightly hard, very friable, nonsticky and nonplastic; many very fine and fine roots; many very fine and fine irregular pores; about 45 percent gravel; neutral (pH 7.2); clear wavy boundary.

Bw1—5 to 17 inches; brown (10YR 4/3) very gravelly loam, pale brown (10YR 6/3) dry; weak fine subangular blocky structure parting to weak fine granular; slightly hard, very friable, nonsticky and nonplastic; many very fine and fine and few medium roots; many very fine and fine and few medium tubular pores; about 35 percent gravel and 10 percent cobbles; neutral (pH 6.8); clear wavy boundary.

Bw2—17 to 21 inches; brown (10YR 5/3) very gravelly loam, very pale brown (10YR 7/3) dry; weak medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; common fine and few medium roots; many fine and few medium tubular pores; about 40 percent gravel and 10 percent cobbles; neutral (pH 7.0); clear wavy boundary.

2C1—21 to 40 inches; brown (10YR 5/3) very gravelly sandy loam, very pale brown (10YR 7/3) dry; massive; slightly hard, friable, nonsticky and nonplastic; common fine roots; common fine tubular pores; about 40 percent gravel and 10 percent cobbles; neutral (pH 7.0); gradual wavy boundary.

2C2—40 to 60 inches; multicolored extremely gravelly loamy sand; massive; loose, nonsticky and nonplastic; about 50 percent gravel, 15 percent cobbles, and 5 percent stones; neutral (pH 7.0).

The depth to bedrock is typically more than 60 inches but is 40 to 60 inches in some pedons. Some pedons have a Cr horizon.

The A horizon has value of 2 or 3 when moist and 3 to 5 when dry and has chroma of 2 or 3 when moist or dry. It has 20 to 50 percent gravel, 0 to 10 percent cobbles, and 0 to 15 percent stones.

The Bw horizon has value of 4 or 5 when moist and 6 or 7 when dry and has chroma of 2 or 3 when moist or dry. It is loam having 35 to 60 percent gravel, 0 to 15 percent cobbles, and 0 to 15 percent stones.

The 2C horizon has value of 5 or 6 when moist and 5 to 7 when dry and has chroma of 2 to 4 when moist or dry. It is sandy loam or loamy sand having 30 to 70 percent gravel, 0 to 30 percent cobbles, and 0 to 15 percent stones.

Shangland Series

The Shangland series consists of moderately deep, well drained soils on hills. These soils formed in residuum derived dominantly from granodiorite. Slope is 2 to 35 percent. Elevation is 3,600 to 4,000 feet. The average annual precipitation is 16 to 20 inches, the average annual air temperature is 45 to 49 degrees F, and the average frost-free period is 110 to 130 days.

Typical pedon of Shangland loam, in an area of Brownlee-Shangland loams, 2 to 12 percent slopes, about 0.5 mile north of Sparta, 200 feet west of road and 100 feet south of the National Forest boundary, NW¼NW¼ sec. 15, T. 8 S., R. 44 E.

A—0 to 8 inches; very dark grayish brown (10YR 3/2) loam, brown (10YR 4/3) dry; moderate fine and medium subangular blocky structure parting to weak fine and medium granular; slightly hard, friable, slightly sticky and slightly plastic; common fine and few coarse roots; many very fine and fine tubular pores; neutral (pH 6.8); gradual wavy boundary.

Bw—8 to 16 inches; dark brown (10YR 4/3) sandy loam, yellowish brown (10YR 5/4) dry; moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and medium and few coarse roots; many fine tubular pores; neutral (pH 6.6); abrupt wavy boundary.

C—16 to 23 inches; yellowish brown (10YR 5/8) loamy sand, brownish yellow (10YR 6/8) dry; massive; soft, very friable, nonsticky and nonplastic; common fine and medium and few coarse roots; about 5 percent gravel; slightly acid (pH 6.4); abrupt wavy boundary.

Cr—23 inches; partially weathered granitic bedrock.

The depth to bedrock is 20 to 40 inches. The mollic epipedon is 12 to 20 inches thick. Reaction is slightly acid or neutral in the solum and substratum.

The A horizon has value of 2 or 3 when moist and 4 or 5 when dry. It has 0 to 15 percent gravel and 0 to 3 percent cobbles.

The Bw horizon has value of 4 or 5 when dry and has chroma of 2 or 3 when moist and 3 or 4 when dry. It is sandy loam or loam having 0 to 15 percent gravel and 0 to 5 percent cobbles.

The C horizon has hue of 10YR or 7.5YR, value of 4 or 5 when moist and 5 or 6 when dry and has chroma of 4 to 8 when moist or dry. It is loamy sand or coarse sandy loam having 0 to 15 percent gravel and 0 to 5 percent cobbles.

Silvies Series

The Silvies series consists of deep, poorly drained soils on flood plains. These soils formed in mixed alluvium that is influenced by loess and volcanic ash in the surface layer. Slope is 0 to 3 percent. Elevation is 3,700 to 5,000 feet. The average annual precipitation is 12 to 25 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 50 to 90 days.

Typical pedon of Silvies silt loam, in an area of Damore-Silvies silt loams, 0 to 3 percent slopes, SE¼NE¼SW¼ sec. 23, T. 13 S., R. 36 E.

A1—0 to 9 inches; black (10YR 2/1) silt loam, very dark gray (10YR 3/1) dry; weak fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine tubular pores; neutral (pH 6.8); clear smooth boundary.

A2—9 to 17 inches; black (10YR 2/1) silt loam, very dark gray (10YR 3/1) dry; moderate fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine tubular pores; neutral (pH 6.8); clear smooth boundary.

AC—17 to 29 inches; very dark gray (10YR 3/1) silty clay loam, dark gray (10YR 4/1) dry; common medium prominent dark yellowish brown (10YR 4/6) mottles; moderate fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; many very fine tubular pores; neutral (pH 7.0); abrupt smooth boundary.

C1—29 to 47 inches; very dark grayish brown (10YR 3/2) silty clay, dark grayish brown (10YR 4/2) dry; massive; hard, firm, sticky and plastic; common fine roots; many very fine tubular pores; neutral (pH 7.2); gradual smooth boundary.

C2—47 to 60 inches; very dark grayish brown (10YR 3/2) clay, dark grayish brown (10YR 4/2) dry; massive; very hard, very firm, very sticky and very plastic; many very fine tubular pores; neutral (pH 7.2).

The depth to bedrock is more than 60 inches. Depth to the C horizon is 20 to 40 inches.

The A horizon has value of 2 when moist or dry and has chroma of 0 or 1 when moist or dry. The structure is weak or moderate fine granular.

The AC horizon has hue of 10YR or 2.5Y, value of 2 to 4 when moist and 3 or 4 when dry, and chroma of 0 to 2 when moist or dry. It has common or many prominent or distinct mottles. It is silty clay loam or silty clay having 35 to 45 percent clay.

The C horizon has hue of 10YR or 2.5Y, value of 2 to 4 when moist and 3 or 4 when dry, and chroma of 0 to 2 when moist or dry. It is silty clay or clay having 45 to 60 percent clay. Some pedons have sand and gravel below a depth of 40 inches.

Simas Series

The Simas series consists of deep, well drained soils on side slopes of old terraces. These soils formed in mixed alluvium. Slope is 12 to 60 percent. Elevation is 2,700 to 3,500 feet. The annual precipitation is 9 to 12 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 120 days.

Typical pedon of Simas gravelly silty clay loam, in an area of Hyall-Simas association, 12 to 35 percent slopes, on an east-facing slope, 350 feet west and 275 feet north of the southeast corner of sec. 8, T. 9 S., R. 45 E.

A1—0 to 2 inches; very dark grayish brown (10YR 3/2) gravelly silty clay loam, dark grayish brown (10YR 4/2) dry; weak very fine and fine granular structure; soft, very friable, slightly sticky and slightly plastic; common very fine and few fine roots; common very fine tubular and irregular pores; about 20 percent gravel and 3 percent cobbles; neutral (pH 7.2); clear smooth boundary.

A2—2 to 8 inches; very dark grayish brown (10YR 3/2) gravelly silty clay loam, dark grayish brown (10YR 4/2) dry; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine and fine roots; few very fine tubular pores; about 15 percent gravel and 5 percent cobbles; neutral (pH 7.2); clear smooth boundary.

AB—8 to 14 inches; very dark grayish brown (10YR 3/2) gravelly silty clay loam, dark grayish brown (10YR 4/2) dry; moderate fine and medium subangular blocky structure parting to fine granular; slightly hard, friable, slightly sticky and slightly plastic; few very fine and fine roots; few very fine tubular pores; about 10 percent gravel and 5 percent cobbles; neutral (pH 7.2); abrupt smooth boundary.

2Bt—14 to 33 inches; dark brown (7.5YR 3/3) clay, dark brown (10YR 3/4) dry; strong medium and coarse subangular blocky structure; very hard, very firm, sticky and plastic; few very fine roots; few very fine tubular pores; continuous faint clay films; slightly effervescent; mildly alkaline (pH 7.4); clear smooth boundary.

2Btk—33 to 48 inches; dark brown (10YR 4/3) clay, brown (10YR 5/3) dry; moderate medium subangular blocky structure; hard, firm, sticky and plastic; few very fine tubular pores; continuous faint clay films; strongly effervescent; common white lime spots; moderately alkaline (pH 8.2); clear smooth boundary.

2Bk—48 to 60 inches, dark brown (10YR 4/3) clay loam, yellowish brown (10YR 5/4) dry; moderate medium subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; strongly effervescent; moderately alkaline (pH 8.2).

The depth to bedrock is more than 60 inches. Depth to the 2Bt horizon is 10 to 20 inches.

The A horizon has value of 2 or 3 when moist and 4 or 5 when dry and has chroma of 1 or 2 when moist or dry. It has 15 to 20 percent gravel and 0 to 10 percent cobbles.

The 2Bt horizon has value of 2 or 3 when moist and 3 to 5 when dry and has chroma of 2 or 3 when moist and 3 or 4 when dry.

The 2Btk horizon has value of 3 or 4 when moist and 4 or 5 when dry and has chroma of 3 or 4 when moist or dry. It is silty clay or clay having 0 to 15 percent gravel and 0 to 10 percent cobbles.

The 2Bk horizon is clay loam or clay having 0 to 20 percent gravel.

Sinker Series

The Sinker series consists of moderately deep, well drained soils on hills. These soils formed in colluvium derived from schist and graywacke. Slope is 12 to 80 percent. Elevation is 3,500 to 5,300 feet. The average annual precipitation is 12 to 16 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 60 to 90 days.

Typical pedon of Sinker very channery loam, in an area of Sinker and Chambeam soils, 35 to 50 percent north slopes, 600 feet east of the southwest corner, SW¼SW¼ sec. 26, T. 11 S., R. 41 E.

A1—0 to 7 inches; very dark gray (10YR 3/1) very channery loam, dark grayish brown (10YR 4/2) dry; weak very fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; many very fine and fine roots; many very fine and fine tubular pores; about 45 percent channers; neutral (pH 6.6); clear smooth boundary.

A2—7 to 15 inches; very dark grayish brown (10YR 3/2) very channery loam, grayish brown (10YR 5/2) dry; moderate very fine and fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; many very fine and fine roots; many very fine and fine tubular pores; about 55 percent channers; neutral (pH 6.6); clear smooth boundary.

Bw1—15 to 23 inches; very dark grayish brown (10YR 3/2) extremely channery loam, brown (10YR 5/3) dry; moderate fine subangular blocky structure; soft, friable, slightly sticky and slightly plastic; common fine roots; many very fine and fine tubular pores; about 60 percent channers; neutral (pH 6.8); clear smooth boundary.

Bw2—23 to 32 inches; dark grayish brown (10YR 4/2) extremely channery loam, light brownish gray (10YR 6/2) dry; weak fine subangular blocky structure; soft, friable, slightly sticky and slightly plastic; few fine roots; common very fine and fine tubular pores; about 55 percent channers and 10 percent flagstones; neutral (pH 6.8); abrupt wavy boundary.

R—32 inches; highly fractured schist.

The depth to bedrock is 20 to 40 inches.

The A horizon has value of 2 or 3 when moist and 4 or 5 when dry and has chroma of 1 to 3 when moist or dry. It has 35 to 45 percent channers and 0 to 5 percent flagstones.

The Bw horizon has value of 2 to 4 when moist and 5 to 7 when dry and has chroma of 2 to 4 when moist or dry. It is loam or clay loam having 35 to 60 percent channers and 0 to 10 percent flagstones.

Sisley Series

The Sisley series consists of moderately deep, well drained soils on mountains. These soils formed in residuum and colluvium derived from schist. Slope is 2 to 70 percent. Elevation is 4,000 to 6,000 feet. The average annual precipitation is 16 to 30 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 50 to 90 days.

Typical pedon of Sisley very channery loam, 2 to 35 percent south slopes, about 5.5 miles east of the Dooley Mountain summit, NE¼SE¼NE¼ sec. 31, T. 11 S., R. 41 E.

Oi—3/4 inch to 0; partially decomposed needles, twigs, and grass.

A—0 to 3 inches; very dark grayish brown (10YR 3/2) very channery loam, brown (10YR 5/3) dry; weak fine granular structure; slightly hard, very friable, nonsticky and nonplastic; many very fine and fine roots; many very fine and fine irregular pores; about 45 percent channers; neutral (pH 6.6); clear wavy boundary.

Bw—3 to 8 inches; dark brown (10YR 4/3) very channery loam, pale brown (10YR 6/3) dry; weak fine subangular structure; slightly hard, very friable, nonsticky and nonplastic; common very fine and fine and few medium roots; common fine tubular pores; about 50 percent channers; neutral (pH 6.8); clear wavy boundary.

C—8 to 24 inches; grayish brown (10YR 5/2) extremely channery sandy loam, light gray (10YR 7/2) dry; massive; slightly hard, very friable, slightly sticky and slightly plastic; few fine and medium roots; common fine tubular pores; about 60 percent channers and 10 percent flagstones; neutral (pH 7.0); clear wavy boundary.

R—24 inches; fractured schist.

The depth to bedrock is 20 to 40 inches.

The A horizon has value of 3 or 4 when moist and 5 or 6 when dry and has chroma of 2 or 3 when moist or dry. It has 30 to 50 percent channers and 0 to 10 percent flagstones.

The Bw horizon has value of 3 to 5 when moist and 6 or 7 when dry and has chroma of 2 or 3 when moist and 3 or 4 when dry. It is loam, sandy loam, or silt loam having 30 to 50 percent channers and 0 to 10 percent flagstones.

The C horizon has value of 4 to 6 when moist and 6 or 7 when dry and has chroma of 2 to 4 when moist or dry. It is silt loam, sandy loam, or loam having 35 to 60 percent channers and 0 to 10 percent flagstones. Some pedons have a Cr horizon.

Skullgulch Series

The Skullgulch series consists of deep, well drained soils on side slopes of terraces. These soils formed in mixed alluvium that is influenced by loess and volcanic ash in the surface layer. Slope is 7 to 60 percent. Elevation is 4,000 to 4,700 feet. The average annual precipitation is 12 to 16 inches, the average annual temperature is 40 to 45 degrees F, and the average frost-free period is 60 to 90 days.

Typical pedon of Skullgulch silt loam, in an area of Campcreek-Skullgulch association, 35 to 60 percent slopes, 700 feet south of the center of sec. 3, T. 13 S., R. 37 E.

A1—0 to 7 inches; very dark grayish brown (10YR 3/2) silt loam, dark grayish brown (10YR 4/2) dry; moderate very fine subangular blocky parting to moderate very fine granular; soft, very friable, nonsticky and nonplastic; many very fine and fine roots; many very fine and fine continuous tubular pores; about 10 percent gravel; mildly alkaline (pH 7.4); clear smooth boundary.

A2—7 to 20 inches; dark brown (10YR 3/3) silt loam, brown (10YR 5/3) dry; moderate very fine and fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; many very fine and fine roots; many very fine and fine continuous tubular pores; about 10 percent gravel; mildly alkaline (pH 7.6); clear smooth boundary.

2Bw—20 to 24 inches; dark brown (10YR 3/3) clay loam, brown (10YR 5/3) dry; moderate fine and very fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and very fine roots; many very fine and fine continuous tubular pores; mildly alkaline (pH 7.8); abrupt smooth boundary.

2Bt—24 to 39 inches; dark yellowish brown (10YR 4/4) clay, yellowish brown (10YR 5/4) dry; strong medium and coarse angular blocky structure; very hard, very firm, very sticky and very plastic; few fine and very fine roots; few very fine discontinuous tubular pores; many prominent clay films on faces of peds and lining pores; mildly alkaline (pH 7.8); gradual smooth boundary.

2Btk—39 to 60 inches; dark yellowish brown (10YR 4/4) clay loam, light yellowish brown (10YR 6/4) dry; moderate fine and very fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine continuous tubular pores; common distinct clay films on faces of peds; violently effervescent with segregated lime blotches; moderately alkaline (pH 8.4).

The depth to bedrock is more than 60 inches. Depth to the 2Bt horizon is 20 to 30 inches. Hue is 10YR or 7.5YR.

The A horizon has value of 2 or 3 when moist and 4 or 5 when dry and has chroma of 2 or 3 when moist or dry. It is silt loam or silty clay loam having 5 to 15 percent gravel.

The 2Bw horizon has value of 2 or 3 when moist and 4 or 5 when dry and has chroma of 2 or 3 when moist or dry. It is loam, clay loam, or silty clay loam having 20 to 35 percent clay. It has 5 to 15 percent gravel.

The 2Bt horizon has value of 4 or 5 when moist or dry and has chroma of 3 or 4 when moist or dry. It is clay or silty clay having 50 to 60 percent clay and 0 to 10 percent gravel.

The 2Btk horizon has value of 4 or 5 when moist and 5 or 6 when dry and has chroma of 4 to 6 when moist or dry. It is clay loam or silty clay loam with 0 to 15 percent gravel. It is strongly effervescent to violently effervescent. Some pedons do not have a 2Btk horizon.

Snaker Series

The Snaker series consists of shallow, well drained soils on hills. These soils formed in colluvium derived from schist. Slope is 30 to 80 percent. Elevation is 2,000 to 4,000 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 45 to 51 degrees F, and the average frost-free period is 100 to 140 days.

Typical pedon of Snaker channery loam, 50 to 80 percent south slopes, about 600 feet west of the Snake River Road, up Canyon Creek, in the southeast corner of NW¼SW¼ sec. 5, T. 11 S., R. 46 E.

A—0 to 3 inches; brown (10YR 4/3) channery loam, light brownish gray (2.5YR 6/2) dry; moderate fine granular and subangular blocky structure; slightly hard, very friable, slightly sticky and nonplastic; common fine and very fine roots; common fine irregular pores; about 25 percent channers and 5 percent flagstones; neutral (pH 7.2); gradual wavy boundary.

AC—3 to 10 inches; brown (10YR 4/3) very channery loam, light brownish gray (2.5YR 6/2) dry; moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and nonplastic; few fine and very fine roots; about 50 percent channers; neutral (pH 7.2); gradual wavy boundary.

C—10 to 16 inches; brown (10YR 5/3) very channery loam, light brownish gray (2.5YR 6/2) dry; massive; slightly hard, friable, slightly sticky and nonplastic; about 45 percent channers; mildly alkaline (pH 7.4); abrupt wavy boundary.

R—16 inches; fractured schist.

The depth to bedrock is 10 to 20 inches. The structure grade is weak or moderate.

The A horizon has hue of 10YR or 2.5YR and value of 6 or 7 when dry.

The AC and C horizons have hue of 10YR or 2.5YR, value of 6 or 7 when dry and 4 or 5 when moist, and chroma of 2 or 3 when dry and 3 when moist. They have 35 to 70 percent rock fragments, dominantly channers.

Snell Series

The Snell series consists of moderately deep, well drained soils on hills. These soils formed in loess and in colluvium derived from basalt. Slope is 12 to 80 percent. Elevation is 3,400 to 5,700 feet. The average annual precipitation is 14 to 20 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 60 to 90 days.

Typical pedon of Snell very cobbly silt loam, in an area of Snell-Sag complex, 50 to 70 percent north slopes, 600 feet south and 800 feet west of center of sec. 32, T. 8 S., R. 46 E.

A—0 to 4 inches; very dark brown (10YR 2/2) very cobbly silt loam, brown (10YR 5/3) dry; weak fine granular structure; soft, friable, nonsticky and nonplastic; many very fine and common fine and medium roots; common very fine and fine tubular and irregular pores; about 25 percent cobbles, 15 percent gravel, and 5 percent stones; neutral (pH 6.8); clear wavy boundary.

AB—4 to 9 inches; very dark brown (10YR 2/2) very cobbly silty clay loam, dark brown (10YR 4/3) dry; weak fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; common very fine and fine tubular pores; about 35 percent cobbles and 20 percent gravel; neutral (pH 6.6); clear wavy boundary.

Bt1—9 to 21 inches; dark brown (7.5YR 3/2) extremely cobbly clay, dark brown (7.5YR 4/4) dry; moderate very fine and fine subangular blocky structure; hard, firm, sticky and plastic; common very fine and few fine roots; common very fine and fine tubular pores; common faint clay films on faces of peds; about 55 percent cobbles and 15 percent gravel; slightly acid (pH 6.4); abrupt irregular boundary.

Bt2—21 to 31 inches; dark brown (7.5YR 3/4) extremely cobbly clay, brown (7.5YR 4/4) dry; moderate very fine subangular blocky structure; very hard, firm, sticky and plastic; few very fine roots, mainly in cracks; few very fine tubular pores; few faint clay films on faces of peds; about 65 percent cobbles and 15 percent gravel; slightly acid (pH 6.2); abrupt wavy boundary.

R—31 inches; fractured basalt.

The thickness of the solum and the depth to bedrock are 20 to 40 inches. The mollic epipedon is 20 to 30 inches thick.

The A and AB horizons have hue of 7.5YR or 10YR, value of 2 or 3 when moist and 3 to 5 when dry, and chroma of 2 or 3 when moist or dry. They have are 0 to 35 percent gravel, 10 to 35 percent cobbles, and 0 to 5 percent stones.

The Bt horizon has hue of 5YR or 7.5YR, value of 3 or 4 when moist and 3 to 5 when dry, and chroma of 2 to 4 when moist or dry. It has 35 to 50 percent clay, 0 to 25 percent gravel, and 40 to 60 percent cobbles.

Snellby Series

The Snellby series consists of moderately deep, well drained soils on hills. These soils formed in colluvium derived from basalt and influenced by volcanic ash and loess in the surface layer. Slope is 12 to 80 percent. Elevation is 3,400 to 3,800 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 41 to 45 degrees F, and the average frost-free period is 60 to 90 days.

Typical pedon of Snellby stony silt loam, 12 to 35 percent north slopes, 300 feet north of the top of Flagstaff Hill, NW¼NW¼ sec. 5, T. 9 S., R. 41 E.

A1—0 to 6 inches; dark brown (10YR 3/3) stony silt loam, grayish brown (10YR 5/2) dry; moderate fine and medium granular structure; soft, very friable, slightly sticky and slightly plastic; many very fine roots; many very fine irregular pores; about 10 percent stones, 5 percent cobbles, and 5 percent gravel; mildly alkaline (pH 7.4); clear wavy boundary.

A2—6 to 10 inches; dark brown (10YR 3/3) stony silty clay loam, brown (10YR 5/3) dry; moderate fine and medium subangular blocky structure; slightly hard, very friable, sticky and plastic; common fine and very fine roots; common very fine tubular pores; about 15 percent stones, 10 percent cobbles, and 5 percent gravel; mildly alkaline (pH 7.4); abrupt wavy boundary.

Bt—10 to 18 inches; dark yellowish brown (10YR 3/4) very stony clay, dark yellowish brown (10YR 4/4) dry; strong medium angular blocky structure; hard, friable, sticky and plastic; common very fine roots; common very fine and fine tubular pores; common distinct clay films on faces of peds and lining pores; lime coating the bottom of rock fragments in the lower part of the horizon; about 25 percent stones, 10 percent cobbles, and 5 percent gravel; mildly alkaline (pH 7.6); clear wavy boundary.

Bk—18 to 24 inches; yellowish brown (10YR 5/4) very stony silty clay loam, pale brown (10YR 6/3) dry; weak fine and medium subangular blocky structure; slightly hard, friable, sticky and plastic; few very fine roots; common very fine and few fine tubular pores; violently effervescent throughout the horizon and segregated lime coating the bottom of rock fragments; about 20 percent stones, 15 percent cobbles, and 10 percent gravel; moderately alkaline (pH 8.2); abrupt wavy boundary.

2R—24 inches; basalt.

The depth to bedrock is 20 to 40 inches. The mollic epipedon is 10 to 20 inches thick.

The A horizon has value of 2 or 3 when moist and has chroma of 2 or 3 when moist or dry. It has 15 to 35 percent rock fragments, mostly stones and cobbles. Reaction is neutral or mildly alkaline.

The Bt horizon has value of 3 or 4 when moist and 4 to 6 when dry and has chroma of 3 or 4 when moist or dry. It has 35 to 60 percent rock fragments, mostly stones and cobbles. The structure grade is moderate or strong, and the structure type is angular or subangular blocky. Reaction is mildly alkaline or moderately alkaline.

The Bk horizon has value of 4 or 5 when moist and 6 or 7 when dry and has chroma of 3 or 4 when moist or dry. It has 35 to 60 percent rock fragments, mostly stones and cobbles.

Stanflow Series

The Stanflow series consists of moderately well drained soils on low terraces. These soils are moderately deep to a weakly cemented hardpan. They formed in mixed alluvium that is influenced by volcanic ash in the surface layer. Slope is 0 to 2 percent. Elevation is 2,000 to 3,500 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 110 to 140 days.

Typical pedon of Stanflow silt loam, in an area of Stanflow-Umapine silt loams, 0 to 2 percent slopes, about 4 miles east of Haines near the Baldock Slough, NE¼NW¼ sec. 6, T. 8 S., R. 40 E.

Akn1—0 to 2 inches; dark grayish brown (10YR 4/2) silt loam, light gray (10YR 7/2) dry; weak thin and medium platy structure; slightly hard, friable, nonsticky and nonplastic; many fine and common medium roots; common very fine and fine tubular and irregular pores; strongly effervescent; very strongly alkaline (pH 10.3); abrupt smooth boundary.

Akn2—2 to 8 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; weak medium and thick platy structure; slightly hard, friable, nonsticky and nonplastic; common fine and medium roots; common very fine and fine tubular pores; strongly effervescent; very strongly alkaline (pH 9.7); abrupt smooth boundary.

Bkn1—8 to 15 inches; dark grayish brown (10YR 4/2) silt loam, light gray (10YR 7/2) dry; massive; slightly hard, friable, nonsticky and nonplastic; common fine and medium roots; common very fine and fine tubular pores; strongly effervescent; very strongly alkaline (pH 9.3); gradual smooth boundary.

Bkn2—15 to 21 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; massive; slightly hard, friable, nonsticky and nonplastic; common fine roots; many fine tubular pores; strongly effervescent; very strongly alkaline (pH 9.2); abrupt smooth boundary.

2Bkqm—21 to 28 inches; dark grayish brown (10YR 4/2) silt loam, light gray (10YR 7/2) dry; massive; hard, firm and brittle, nonsticky and nonplastic; weakly cemented; few very fine roots; many very fine and few fine tubular pores; violently effervescent; strongly alkaline (pH 8.7); gradual smooth boundary.

2Bk1—28 to 39 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; massive; slightly hard, friable, nonsticky and nonplastic; very few fine and very fine roots; many very fine and fine tubular pores; strongly effervescent; moderately alkaline (pH 8.2); abrupt smooth boundary.

2Bk2—39 to 60 inches; brown (10YR 4/3) loam, pale brown (10YR 6/3) dry; massive; slightly hard, friable, slightly sticky and slightly plastic; slightly effervescent; moderately alkaline (pH 8.2).

The depth to bedrock is more than 60 inches. Depth to the weakly cemented hardpan is 20 to 40 inches. Reaction is very strongly alkaline to moderately alkaline throughout the profile. The alkalinity decreases with increasing depth.

The Akn and Bkn horizons have value of 3 or 4 when moist and 5 to 7 when dry and have chroma of 2 or 3 when moist or dry.

The 2Bkqm horizon has value of 3 or 4 when moist and 5 to 7 when dry.

The 2Bk horizon has value of 3 or 4 when moist and 6 or 7 when dry and has chroma of 2 or 3 when moist or dry. It is silt loam or loam having 0 to 25 percent gravel.

Stavely Series

The Stavely series consists of deep, well drained soils on mountains. These soils formed in residuum and colluvium weathered from rhyolite and andesite tuff. Slope is 20 to 50 percent. Elevation is 4,000 to 6,000 feet. The average annual precipitation is 20 to 30 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 60 to 90 days.

Typical pedon of Stavely coarse sandy loam, 20 to 50 percent south slopes, about 2 miles east of Dooley Mountain Road, SE¼SW¼SW¼ sec. 10, T. 12 S., R. 40 E.

Oi—1 inch to 0; partially decomposed organic litter, mostly pine needles.

A—0 to 2 inches; very dark brown (10YR 2/2) coarse sandy loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; soft, very friable, nonsticky and nonplastic; common very fine roots; many very fine irregular pores; about 10 percent gravel; neutral (pH 6.8); abrupt wavy boundary.

Bw1—2 to 11 inches; very dark grayish brown (10YR 3/2) coarse sandy loam, light brownish gray (10YR 6/2) dry; weak fine subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; few fine and medium roots; common very fine tubular pores; about 10 percent gravel; neutral (pH 6.6); clear wavy boundary.

Bw2—11 to 26 inches; very dark grayish brown (10YR 3/2) gravelly coarse sandy loam, light brownish gray (10YR 6/2) dry; weak fine subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; few fine and medium roots; common very fine and few fine and medium tubular pores; about 20 percent gravel; neutral (pH 6.6); clear wavy boundary.

C1—26 to 40 inches; light brownish gray (10YR 6/2) gravelly coarse sandy loam, light gray (10YR 7/2) dry; massive; slightly hard, very friable, nonsticky and nonplastic; few fine, medium, and coarse roots; common fine tubular pores; about 20 percent gravel and 10 percent cobbles; neutral (pH 6.6); clear wavy boundary.

C2—40 to 52 inches; light brownish gray (10YR 6/2) gravelly loamy coarse sand, light gray (10YR 7/2) dry; massive; slightly hard, very friable, nonsticky and nonplastic; few fine and medium roots; common fine tubular pores; about 30 percent gravel; neutral (pH 7.2); clear wavy boundary.

C3—52 to 62 inches; light brownish gray (10YR 6/2) very gravelly loamy coarse sand, white (10YR 8/2) dry; massive; slightly hard, very friable, nonsticky and nonplastic; few fine and medium roots; common fine tubular pores; about 50 percent gravel; neutral (pH 7.2).

The depth to bedrock is more than 60 inches.

The A horizon has value of 2 or 3 when moist and 4 or 5 when dry and has chroma of 2 or 3 when moist or dry. It has 10 to 15 percent gravel and 0 to 5 percent cobbles.

The Bw horizon has value of 3 or 4 when moist and has chroma of 2 or 3 when moist or dry. It has 10 to 20 percent gravel and 0 to 5 percent cobbles.

The C horizon has value of 5 or 6 when moist and 7 or 8 when dry and has chroma of 3 or 4 when moist or dry. The C1 and C2 horizons are loamy coarse sand or coarse sandy loam. They have 20 to 50 percent gravel and 0 to 10 percent cobbles.

Stices Series

The Stices series consists of deep, well drained soils on mountains. These soils formed in colluvium derived from rhyolite and andesite and have a mantle of volcanic ash. Slope is 35 to 80 percent. Elevation is 4,000 to 6,000 feet. The average annual precipitation is 20 to 35 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 30 to 60 days.

Typical pedon of Stices gravelly loam, 50 to 80 percent north slopes, about 1.75 miles west of the Dooley Mountain summit, SE¼SE¼NE¼ sec. 31, T. 11 S., R. 40 E.

Oi—1 inch to 0; partially decomposed needles, twigs, and grass.

A—0 to 3 inches; dark brown (10YR 3/3) gravelly loam, yellowish brown (10YR 5/4) dry; weak fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine and fine roots; many very fine and fine irregular pores; about 20 percent gravel; neutral (pH 6.8); clear wavy boundary.

Bw1—3 to 12 inches; dark yellowish brown (10YR 4/4) very gravelly loam, light yellowish brown (10YR 6/4) dry; weak fine subangular blocky structure parting to weak fine granular; soft, very friable, nonsticky and nonplastic; many fine and few medium roots; many very fine and fine and few medium tubular pores; about 35 percent gravel and 10 percent cobbles; neutral (pH 6.8); clear wavy boundary.

Bw2—12 to 21 inches; brown (10YR 5/3) very gravelly loam, very pale brown (10YR 7/3) dry; weak medium subangular blocky structure parting to weak fine granular; soft, very friable, nonsticky and nonplastic; common fine and few medium roots; many fine and few medium tubular pores; about 40 percent gravel and 10 percent cobbles; neutral (pH 7.0); clear wavy boundary.

2C1—21 to 40 inches; brown (10YR 5/3) extremely gravelly sandy loam, very pale brown (10YR 7/3) dry; massive; slightly hard, very friable, nonsticky and nonplastic; common fine roots; common fine tubular pores; about 50 percent gravel and 15 percent cobbles; neutral (pH 7.0); clear wavy boundary.

2C2—40 to 60 inches; multicolored extremely gravelly loamy sand; massive; loose, nonsticky and nonplastic; about 60 percent gravel and 10 percent cobbles; neutral (pH 7.0).

The depth to bedrock is typically more than 60 inches but is 40 to 60 inches in some pedons. The mantle of volcanic ash is 14 to 30 inches thick.

The A horizon has value of 2 or 3 when moist and 3 to 5 when dry. It has 15 to 30 percent gravel.

The Bw horizon has value of 3 to 5 when moist and 5 to 7 when dry and has chroma of 2 to 4 when moist and 3 or 4 when dry. It has 20 to 50 percent gravel, 0 to 10 percent cobbles, and 0 to 10 percent stones. Reaction is slightly acid or neutral.

The 2C horizon has value of 5 or 6 when moist and 6 or 7 when dry and has chroma of 3 or 4 when moist or dry. It is sandy loam or loamy sand having 40 to 70 percent gravel, 10 to 25 percent cobbles, and 0 to 5 percent stones.

Stovepipe Series

The Stovepipe series consists of deep, poorly drained soils on flood plains. These soils formed in mixed alluvium that is influenced by loess and volcanic ash in the surface layer. Slope is 0 to 3 percent. Elevation is 3,800 to 4,200 feet. The average annual precipitation is 16 to 24 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 50 to 90 days.

Typical pedon of Stovepipe silt loam, in an area of Sumpley-Stovepipe silt loams, 0 to 3 percent slopes, about 50 feet south of Highway 7 near the intersection with Hudspeth Lane in Sumpter Valley, NE¼NE¼SE¼ sec. 18, T. 10 S., R. 38 E.

A1—0 to 6 inches; black (10YR 2/1) silt loam, grayish brown (10YR 5/2) dry; many medium distinct yellowish brown (10YR 5/6) mottles; moderate very fine and fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine and few medium roots; many very fine tubular pores; about 10 percent gravel; neutral (pH 6.8); clear smooth boundary.

A2—6 to 13 inches; very dark gray (10YR 3/1) silt loam, grayish brown (10YR 5/2) dry; many medium distinct gray (10YR 5/1) mottles; moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine and few medium roots; many very fine tubular pores; about 10 percent gravel; neutral (pH 6.8); clear smooth boundary.

Bg—13 to 24 inches; gray (2.5Y 5/0) silt loam, light gray (2.5Y 7/2) dry; many coarse distinct gray (10YR 5/1) and few medium distinct yellowish brown (10YR 5/6) mottles; moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine and few medium roots; many very fine tubular pores; about 10 percent 2- to 4-millimeter concretions; neutral (pH 7.0); abrupt smooth boundary.

2Cg1—24 to 33 inches; dark gray (5Y 4/1) extremely gravelly loamy sand, light gray (5Y 7/1) dry; many coarse distinct yellowish brown (10YR 5/6) mottles; single grain; loose, nonsticky and nonplastic; few fine and medium roots; many very fine and fine irregular pores; about 50 percent gravel and 15 percent cobbles; mildly alkaline (pH 7.6); gradual smooth boundary.

2Cg2—33 to 60 inches; multicolored extremely gravelly sand; single grain; loose, nonsticky and nonplastic.

The depth to bedrock is more than 60 inches. The depth to a contrasting substratum of extremely gravelly material is 20 to 40 inches.

The A horizon has value of 2 or 3 when moist and 4 or 5 when dry and has chroma of 1 or 2 when moist or dry. It has common or many distinct or prominent mottles. It has 0 to 10 percent gravel.

The Bg horizon has hue of 2.5Y or 5Y, value of 4 or 5 when moist and 6 or 7 when dry, and chroma of 0 to 2 when moist or dry. It has distinct or prominent mottles. It has 10 to 18 percent clay and 0 to 15 percent gravel.

The 2Cg horizon has hue of 5Y or 2.5Y, value of 4 or 5 when moist and 6 or 7 when dry, and chroma of 0 to 2 when moist or dry. It has distinct or prominent mottles. It is loamy sand or sand having 40 to 60 percent gravel and 10 to 20 percent cobbles.

Sumpley Series

The Sumpley series consists of deep, somewhat poorly drained soils on flood plains. These soils formed in mixed alluvium that is influenced by loess and volcanic ash in the surface layer. Slope is 0 to 3 percent. Elevation is 3,800 to 4,200 feet. The average annual precipitation is 16 to 24 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 50 to 90 days.

Typical pedon of Sumpley silt loam, in an area of Sumpley-Stovepipe silt loams, 0 to 3 percent slopes, about 100 feet south and 75 feet west of the intersection of Highway 7 and Hudspeth Lane in Sumpter Valley, NE¼NE¼SE¼ sec. 18, T. 10 S., R. 38 E.

A1—0 to 7 inches; very dark gray (10YR 3/1) silt loam, gray (10YR 5/1) dry; moderate very fine and fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine tubular pores; about 10 percent gravel; mildly alkaline (pH 7.8); clear smooth boundary.

A2—7 to 14 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; moderate medium platy structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine tubular pores; about 10 percent gravel; moderately alkaline (pH 8.2); clear smooth boundary.

2Bw—14 to 27 inches; dark grayish brown (10YR 4/2) loam, light brownish gray (10YR 6/2) dry; common fine distinct dark brown (10YR 4/3) mottles; moderate fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; many fine tubular pores; common faint clay films in pores; common very fine 2-millimeter concretions; about 10 percent gravel; mildly alkaline (pH 7.8); gradual smooth boundary.

2Bt—27 to 34 inches; dark grayish brown (10YR 4/2) loam, light brownish gray (10YR 6/2) dry; many fine distinct gray (10YR 5/1) and few fine distinct dark yellowish brown (10YR 4/4) mottles; moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine roots; many very fine and fine tubular pores; common faint clay films in pores; about 10 percent gravel; mildly alkaline (pH 7.6); abrupt smooth boundary.

3Cg—34 to 60 inches; dark gray (5Y 4/1) extremely gravelly loamy sand, light gray (5Y 7/1) dry; many medium distinct gray (10YR 5/1) and common fine distinct dark yellowish brown (10YR 4/4) mottles; massive; loose, nonsticky and nonplastic; few fine roots; many very fine and fine irregular pores; about 55 percent gravel and 10 percent cobbles; neutral (pH 7.2).

The depth to bedrock is more than 60 inches. Depth to the extremely gravelly substratum is 20 to 40 inches.

The A horizon has value of 2 or 3 when moist and 4 or 5 when dry and has chroma of 1 or 2 when moist or dry. It has 0 to 10 percent gravel. In some pedons the A2 horizon has few fine distinct mottles.

The 2B horizon has value of 4 or 5 when moist and 6 or 7 when dry and has chroma of 1 or 2 when moist or dry. It has common or many distinct or prominent mottles. It is loam or sandy clay loam having 20 to 25 percent clay, 10 to 20 percent gravel, and 0 to 5 percent cobbles.

The 3Cg horizon has hue of 5Y or 2.5Y and generally is gleyed. It has value of 4 or 5 when moist and 6 or 7 when dry and has chroma of 1 or 2 when moist or dry. It has distinct or prominent mottles. It is loamy sand or sand having 40 to 60 percent gravel and 10 to 20 percent cobbles.

Taterpa Series

The Taterpa series consists of deep, well drained soils on mountains. These soils formed in colluvium and residuum derived from quartz diorite and related granitic rocks. Slope is 12 to 60 percent. Elevation is 4,000 to 6,200 feet. The average annual precipitation is 16 to 20 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 60 to 90 days.

Typical pedon of Taterpa loam, 35 to 60 percent north slopes, 900 feet north and 100 feet west of the southeast corner of sec. 14, T. 13 S., R. 42 E.

A1—0 to 4 inches; black (10YR 2/1) loam, very dark grayish brown (10YR 3/2) dry; weak medium granular structure; soft, very friable, nonsticky and nonplastic; many very fine and fine and few medium roots; common very fine and fine irregular pores; about 5 percent gravel; neutral (pH 6.8); clear smooth boundary.

A2—4 to 13 inches; black (10YR 2/1) loam, very dark grayish brown (10YR 3/2) dry; moderate fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; many very fine and fine roots; common very fine and fine tubular pores; about 10 percent gravel; neutral (pH 6.8); clear smooth boundary.

Bw1—13 to 25 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; moderate fine and medium subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; common very fine and fine roots; common fine tubular pores; about 10 percent gravel; neutral (pH 6.6); gradual smooth boundary.

Bw2—25 to 34 inches; very dark grayish brown (10YR 3/2) gravelly loam, brown (10YR 5/3) dry; moderate medium subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; common very fine roots; common fine tubular pores; about 20 percent gravel; slightly acid (pH 6.4); clear smooth boundary.

C1—34 to 41 inches; dark brown (10YR 3/3) gravelly sandy loam, yellowish brown (10YR 5/4) dry; massive; hard, firm, slightly sticky and slightly plastic; few very fine and fine roots; few very fine and fine tubular pores; about 20 percent gravel; slightly acid (pH 6.2); clear smooth boundary.

C2—41 to 49 inches; brown (10YR 4/3) gravelly sandy loam, yellowish brown (10YR 5/4) dry; massive; slightly hard, friable, nonsticky and nonplastic; few very fine roots; few very fine tubular pores; about 30 percent gravel; slightly acid (pH 6.2); clear wavy boundary.

Cr—49 inches; highly weathered quartz diorite.

The depth to bedrock is 40 to 60 inches.

The A horizon has value of 2 or 3 when moist and 3 or 4 when dry and has chroma of 1 to 3 when moist or dry. It has 0 to 10 percent gravel.

The Bw horizon has value of 2 or 3 when moist and 4 or 5 when dry, and chroma of 2 to 4 when moist or dry. It is loam or sandy loam having 0 to 20 percent gravel.

The C horizon has value of 4 or 5 when moist and 5 or 6 when dry and has chroma of 3 or 4 when moist or dry. It is sandy loam or loamy sand having 15 to 30 percent gravel.

Tolo Series

The Tolo series consists of deep, well drained soils on mountains. These soils formed in volcanic ash over older loamy mixed colluvium. Slope is 12 to 35 percent. Elevation is 3,800 to 5,000 feet. The average annual precipitation is 20 to 35 inches, the average annual air temperature is 42 to 45 degrees F, and the average frost-free period is 30 to 50 days.

Typical pedon of Tolo silt loam, in an area of Tolo-Dogtown complex, 12 to 35 percent north slopes, 1,500 feet east and 2,300 feet north of the southwest corner of sec. 3, T. 8 S., R. 38 E.

Oi—2 inches to 0; partially decomposed fir needles, grass, and moss.

A1—0 to 4 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak fine granular structure; soft, very friable, nonsticky and nonplastic; weakly smeary; many very fine and fine and few medium roots; many very fine and fine irregular pores; about 10 percent gravel; neutral (pH 6.6); clear smooth boundary.

A2—4 to 15 inches; dark brown (10YR 3/3) silt loam, light brownish gray (10YR 6/2) dry; weak fine and medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; many very fine and fine and few medium roots; many very fine and fine tubular pores; about 10 percent gravel; slightly acid (pH 6.4); clear smooth boundary.

Bw—15 to 29 inches; dark brown (10YR 3/3) silt loam, pale brown (10YR 6/3) dry; moderate fine and medium subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; many very fine and fine and few medium roots; common very fine and fine tubular pores; about 5 percent gravel; slightly acid (pH 6.4); abrupt wavy boundary.

2Btb1—29 to 37 inches; dark brown (10YR 3/3) gravelly sandy clay loam, brown (10YR 5/3) dry; moderate medium subangular blocky structure; slightly hard, firm, nonsticky and nonplastic; common very fine and fine and few medium roots; common very fine and fine tubular pores; few faint clay films on faces of peds; about 20 percent gravel; slightly acid (pH 6.2); clear smooth boundary.

2Btb2—37 to 49 inches; dark brown (10YR 3/3) gravelly sandy clay loam, brown (10YR 5/3) dry; moderate medium and coarse subangular blocky structure; hard, firm, nonsticky and nonplastic; few fine and medium roots; few fine tubular pores; few faint clay films on faces of peds; about 30 percent gravel; moderately acid (pH 6.0); clear smooth boundary.

2C—49 to 60 inches; brown (10YR 4/3) gravelly sandy loam, pale brown (10YR 6/3) dry; weak medium subangular blocky structure; slightly hard, firm, nonsticky and nonplastic; about 50 percent gravel; moderately acid (pH 6.0).

The depth to bedrock is typically more than 60 inches but is 40 to 60 inches in some pedons. The mantle of volcanic ash is 20 to 30 inches thick.

The A and Bw horizons have value of 2 or 3 when moist and 5 or 6 when dry and have chroma of 2 or 3 when moist or dry.

The 2Btb horizon has value of 3 or 4 when moist and 5 or 6 when dry and has chroma of 3 or 4 when moist or dry. It is sandy loam or sandy clay loam having 15 to 30 percent gravel.

The 2C horizon has value of 5 to 7 when dry and has chroma of 3 or 4 when moist or dry. It has 15 to 40 percent gravel.

Top Series

The Top series consists of deep, well drained soils on mountains. These soils formed in loess and in colluvium derived from basalt. Slope is 12 to 65 percent. Elevation is 3,300 to 5,000 feet. The average annual precipitation is 20 to 30 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 30 to 90 days.

Typical pedon of Top silt loam, 35 to 60 percent north slopes, about 5 miles northwest of Halfway along fence line 200 feet east of National Forest Road, at the southwest corner of NW¼NW¼ sec. 26, T. 7 S., R. 43 E.

Oi—1 inch to 0; partially decomposed organic litter, mostly pine needles.

A1—0 to 3 inches; very dark grayish brown (10YR 3/2) silt loam, dark brown (10YR 4/3) dry; moderate fine granular structure; soft, very friable, nonsticky and nonplastic; common very fine and fine roots; common very fine and fine irregular pores; neutral (pH 6.8); abrupt wavy boundary.

A2—3 to 9 inches; dark brown (7.5YR 3/2) silt loam, dark grayish brown (10YR 4/2) dry; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine, fine, and medium roots; many very fine tubular pores; about 3 percent gravel; neutral (pH 7.0); abrupt wavy boundary.

BA—9 to 20 inches; dark brown (7.5YR 3/2) silty clay loam, dark brown (10YR 4/3) dry; moderate medium angular blocky structure; hard, firm, slightly sticky and slightly plastic; few very fine, fine, and medium roots; common very fine tubular pores; about 5 percent gravel; slightly acid (pH 6.2); clear wavy boundary.

Bt1—20 to 28 inches; dark reddish brown (5YR 3/3) cobbly silty clay, brown (7.5YR 4/4) dry; strong fine and medium subangular blocky structure; hard, firm, sticky and plastic; few fine roots; common very fine tubular pores; few faint clay films on faces of peds; about 5 percent gravel and 15 percent cobbles; slightly acid (pH 6.2); clear wavy boundary.

Bt2—28 to 39 inches; dark reddish brown (5YR 3/3) cobbly silty clay, brown (7.5YR 4/4) dry; strong fine and medium subangular blocky structure; hard, firm, sticky and plastic; few fine tubular pores; common distinct clay films on faces of peds; moderately acid (pH 6.0); about 10 percent gravel, 15 percent cobbles, and 5 percent stones; clear wavy boundary.

Bt3—39 to 48 inches; dark reddish brown (5YR 3/3) silty clay loam, brown (7.5YR 4/4) dry; moderate fine and medium subangular blocky structure; hard, firm, sticky and plastic; few fine tubular pores; few faint clay films; moderately acid (pH 6.0); about 10 percent cobbles; abrupt wavy boundary.

2R—48 inches; fractured basalt bedrock.

The depth to bedrock is 40 to 60 inches.

The A horizon has hue of 10YR or 7.5YR, value of 4 or 5 when dry, and chroma of 2 or 3 when moist or dry.

The Bt horizon has hue of 5YR to 10YR, value of 4 or 5 when dry, and chroma of 2 to 4 when moist or dry. It is silty clay loam, silty clay, or clay having 35 to 45 percent clay, 0 to 10 percent gravel, and 0 to 15 percent cobbles.

Typic Xerorthents

These soils consist of tailings left from gold dredging operations. The soils are mainly on flood plains or low terraces. Slope is 2 to 12 percent. Elevation is 2,000 to 5,000 feet. The average annual precipitation is 9 to 24 inches, the average annual air temperature is 40 to 50 degrees F, and the average frost-free period is 50 to 140 days.

Typical pedon of Typic Xerorthents, 2 to 12 percent slopes, in Sumpter Valley, SE¼SE¼SE¼ sec. 18, T. 10 S., R. 38 E.

0 to 99 inches; multicolored extremely cobbly loamy sand, gray (N 5/0) dry; single grain; loose, nonsticky and nonplastic; structureless; few fine and medium roots; many fine irregular pores; about 70 percent cobbles, 5 percent stones, and 15 percent gravel; mildly alkaline (pH 7.6).

These areas consist of large mounds of rounded and subrounded stones, cobbles, and gravel. Most of the fines (sand, silt, and clay) were washed away during the dredging operations. The top of the ridge is mainly 15 to 20 feet above the bottom of the trough. The tops of the ridges are about 100 feet apart and about 200 to 1,500 feet long. The troughs are generally partly filled with water.

The amount of rock fragments is variable, ranging from 10 to 45 percent gravel, 50 to 90 percent cobbles, and 0 to 20 percent stones.

Ukiah Series

The Ukiah series consists of moderately deep, well drained soils on hills. These soils formed in colluvium derived from volcanic tuff and basalt. Slope is 2 to 20 percent. Elevation is 2,400 to 4,000 feet. The average annual precipitation is 14 to 20 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 120 days.

Typical pedon of Ukiah silty clay loam, 12 to 20 percent slopes, about 2.5 miles south of Halfway, 1,600 feet south and 800 feet east of the northwest corner of sec. 28, T. 8 S., R. 46 E.

A—0 to 2 inches; very dark brown (10YR 2/2) silty clay loam, dark grayish brown (10YR 4/2) dry; moderate fine and medium granular structure; hard, firm, slightly sticky and slightly plastic; many very fine and fine roots; many very fine and fine pores; neutral (pH 6.6); abrupt smooth boundary.

BA—2 to 10 inches; very dark grayish brown (10YR 3/2) silty clay, brown (10YR 4/3) dry; moderate medium and fine subangular blocky structure; hard, firm, sticky and plastic; common very fine and fine roots; neutral (pH 6.6); clear smooth boundary.

Bt1—10 to 18 inches; dark brown (7.5YR 3/2) clay, brown (7.5YR 4/2) dry; strong coarse and medium angular blocky structure; very hard, very firm, very sticky and very plastic; few very fine and fine roots; common distinct clay films on faces of peds; neutral (pH 6.6); clear smooth boundary.

Bt2—18 to 28 inches; dark brown (7.5YR 3/3) clay, brown (7.5YR 4/2) dry; strong coarse and medium angular blocky structure; very hard, very firm, very sticky and very plastic; few very fine roots; many distinct clay films on faces of peds; neutral (pH 6.8); abrupt smooth boundary.

C—28 to 36 inches; brown (7.5YR 4/4) loam, reddish yellow (7.5YR 6/6) dry; massive; hard, firm, nonsticky and nonplastic; neutral (pH 7.2); gradual smooth boundary.

2Cr—36 inches; highly weathered volcanic tuff.

The depth to bedrock is 20 to 40 inches. Hue is 10YR or 7.5YR.

The A and BA horizons have value of 2 or 3 when moist and 3 or 4 when dry and have chroma of 1 to 3 when moist or dry.

The Bt horizon has value of 2 or 3 when moist and 4 or 5 when dry and has chroma of 2 or 3 when moist or dry. It is silty clay or clay and has 40 to 60 percent clay.

The C horizon is silty clay loam or loam.

Umapine Series

The Umapine series consists of deep, somewhat poorly drained soils on low terraces. These soils formed in mixed alluvium that is influenced by loess and volcanic ash. Slope is 0 to 2 percent. Elevation is 2,000 to 3,500 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 110 to 140 days.

Typical pedon of Umapine silt loam, 0 to 2 percent slopes, about 0.25 mile north of Medical Springs Road and 200 feet west of Sunnyslope Road, NE¼SE¼SE¼ sec. 14, T. 8 S., R. 40 E.

Akn1—0 to 4 inches; brownish gray (10YR 5/2) silt loam, light gray (10YR 7/2) dry; weak thin platy structure; slightly hard, friable, nonsticky and nonplastic; few medium roots; many fine and medium vesicular pores; strongly effervescent; very strongly alkaline (pH 9.4); abrupt smooth boundary.

Akn2—4 to 7 inches; brownish gray (10YR 5/2) silt loam, light gray (10YR 7/2) dry; weak thin and medium platy structure; slightly hard, friable, nonsticky and nonplastic; few fine and medium roots; many fine and medium vesicular pores; slightly effervescent; very strongly alkaline (pH 9.4); abrupt smooth boundary.

ABkn—7 to 12 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; moderate very fine and fine subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; few fine roots; many very fine and fine tubular pores; slightly effervescent; very strongly alkaline (pH 9.4); clear smooth boundary.

Bkn1—12 to 19 inches; grayish brown (10YR 5/2) silt loam, light gray (10YR 7/2) dry; massive; slightly hard, friable, nonsticky and nonplastic; few fine roots; few very fine and fine tubular pores; violently effervescent; very strongly alkaline (pH 9.4); gradual wavy boundary.

Bkn2—19 to 30 inches; grayish brown (10YR 5/2) silt loam, light gray (10YR 7/2) dry; few faint yellowish brown (10YR 5/6) mottles; massive; hard, friable, nonsticky and nonplastic; common very fine and fine tubular pores; violently effervescent; very strongly alkaline (pH 9.4); gradual smooth boundary.

Bkn3—30 to 40 inches; brown (10YR 5/3) silt loam, very pale brown (10YR 7/3) dry; massive; slightly hard, friable, nonsticky and nonplastic; few very fine and fine tubular pores; slightly effervescent; very strongly alkaline (pH 9.4); gradual smooth boundary.

Cn—40 to 60 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; massive; slightly hard, friable, nonsticky and nonplastic; common very fine and fine tubular pores; very strongly alkaline (pH 9.4).

The depth to bedrock is more than 60 inches. The upper 40 inches is very strongly alkaline or strongly alkaline.

The Akn horizon has value of 3 to 5 when moist and 6 or 7 when dry and has chroma of 1 or 2 when moist or dry.

The ABkn horizon has value of 4 or 5 when moist and 6 or 7 when dry and has chroma of 1 or 2 when moist or dry.

The Bkn horizon has value of 4 to 6 when moist and 6 to 8 when dry and has chroma of 1 or 2 when moist or dry in the upper part and 1 to 3 when moist or dry in the lower part. At a depth of more than 40 inches it is mildly alkaline to very strongly alkaline.

Virtue Series

The Virtue series consists of well drained soils on fans and terraces. These soils are moderately deep to a duripan. They formed in lacustrine and alluvial sediments that are influenced by volcanic ash and loess in the surface layer. Slope is 2 to 12 percent. Elevation is 2,700 to 4,000 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 110 to 130 days.

Typical pedon of Virtue silt loam, 2 to 7 percent slopes, 315 feet east of fence, S½NW¼SW¼ sec. 10, T. 9 S., R. 41 E.

A1—0 to 7 inches; dark brown (10YR 3/3) silt loam, brown (10YR 5/3) dry; weak fine and very fine granular structure; soft, friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine tubular pores; neutral (pH 6.6); clear smooth boundary.

A2—7 to 15 inches; dark brown (10YR 4/3) silty clay loam, pale brown (10YR 6/3) dry; weak medium subangular blocky structure; soft, friable, sticky and plastic; many very fine and fine roots; many very fine and fine tubular pores; neutral (pH 7.0); gradual smooth boundary.

Bt—15 to 22 inches; dark yellowish brown (10YR 4/4) silty clay loam, yellowish brown (10YR 5/4) dry; moderate fine and medium subangular blocky structure; hard, friable, sticky and plastic; few very fine roots; many very fine tubular pores; few faint clay films on faces of peds and lining pores; moderately alkaline (pH 8.0); gradual smooth boundary.

Btk—22 to 25 inches; yellowish brown (10YR 5/4) silty clay loam, dark yellowish brown (10YR 6/4) dry; moderate fine subangular blocky structure; hard, friable, sticky and plastic; few very fine roots; many very fine tubular pores; few faint clay films on faces of peds and lining pores; slightly effervescent; moderately alkaline (pH 8.2); gradual smooth boundary.

2Bk—25 to 29 inches; dark yellowish brown (10YR 4/4) loam, light yellowish brown (10YR 6/4) dry; massive; slightly hard, friable, slightly sticky and slightly plastic; strongly effervescent; moderately alkaline (pH 8.4); abrupt wavy boundary.

2Bkqm—29 to 42 inches; grayish brown (10YR 5/2), silica-cemented duripan; indurated plates; weakly cemented, calcareous loam between the plates; very firm and friable; nearly continuous silica coatings on surface of plates; violently effervescent; moderately alkaline (pH 8.4); gradual wavy boundary.

3Bkq—42 to 60 inches; light yellowish brown (10YR 6/4) very gravelly loam, very pale brown (10YR 8/3) dry; massive; slightly hard, friable, nonsticky and nonplastic; weakly cemented; about 50 percent gravel and 5 percent cobbles; strongly effervescent; moderately alkaline (pH 8.4).

The depth to bedrock is more than 60 inches. Depth to the duripan is 20 to 40 inches.

The A horizon has value of 3 or 4 when moist and 5 or 6 when dry and has chroma of 2 to 4 when moist or dry. It is silt loam or gravelly silt loam having 0 to 50 percent gravel and 0 to 5 percent cobbles.

The Bt and Btk horizons have value of 3 to 5 when moist and 5 or 6 when dry and have chroma of 3 or 4 when moist or dry. They are silty clay loam or silt loam. The Btk horizon is weakly calcareous or moderately calcareous.

The 2Bk horizon has 0 to 5 percent gravel. Some pedons do not have a 2Bk horizon.

The 2Bkqm horizon has indurated plates or layers that have weakly cemented soil material between them. In some pedons the duripan is massive and is indurated in the upper part and weakly cemented to strongly cemented in the lower part.

The 3Bkq horizon has value of 4 to 6 when moist and 5 to 8 when dry and has chroma of 3 or 4 when moist or dry. It is loam or sandy loam having 15 to 55 percent gravel and 0 to 5 percent cobbles. It is weakly cemented in some pedons.

Wahstal Series

The Wahstal series consists of well drained soils on the top of old terraces and on the adjacent fans. These soils are shallow to a duripan. They formed in mixed alluvium. Slope is 2 to 12 percent. Elevation is 4,700 to 5,200 feet. The average annual precipitation is 12 to 16 inches, the average annual temperature is 40 to 45 degrees F, and the average frost-free period is 60 to 90 days.

Typical pedon of Wahstal very cobbly loam, 2 to 12 percent slopes, 350 feet north and 150 feet west of the southeast corner, SE¼SE¼SE¼ sec. 36, T. 13 S., R. 36 E.

A1—0 to 4 inches; very dark grayish brown (10YR 3/2) very cobbly loam, grayish brown (10YR 5/2) dry; moderate very fine and fine subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; many fine and few medium roots; many very fine and fine tubular pores; about 35 percent cobbles and 15 percent gravel; slightly acid (pH 6.2); clear smooth boundary.

A2—4 to 12 inches; dark brown (10YR 3/3) very cobbly clay loam, brown (10YR 5/3) dry; moderate fine subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; many fine and few medium roots; many very fine and fine tubular pores; about 35 percent cobbles and 20 percent gravel; neutral (pH 6.6); abrupt smooth boundary.

2Bt—12 to 18 inches; dark yellowish brown (10YR 4/4) extremely cobbly clay, yellowish brown (10YR 5/4) dry; strong coarse and medium angular blocky structure; very hard, very firm, very sticky and very plastic; few fine roots; few very fine and fine tubular pores; many prominent clay films on faces of peds and lining pores; about 45 percent cobbles and 25 percent gravel; slightly acid (pH 6.2); abrupt smooth boundary.

2Bqm—18 to 23 inches; yellowish brown (10YR 5/4) and brownish yellow (10YR 6/6) duripan; indurated; massive; very hard; about 40 percent cobbles and 25 percent gravel; slightly acid (pH 6.4); abrupt wavy boundary.

3C—23 to 60 inches; multicolored extremely cobbly sandy loam; massive; about 50 percent cobbles and 25 percent gravel; neutral (pH 6.8).

The depth to bedrock is more than 60 inches. Depth to the duripan is 10 to 20 inches.

The A horizon has value of 2 or 3 when moist and 4 or 5 when dry and has chroma of 2 or 3 when moist or dry. It has 10 to 20 percent gravel and 30 to 40 percent cobbles.

The 2Bt horizon has value of 4 or 5 when moist or dry and has chroma of 3 or 4 when moist or dry. It is clay or silty clay having 50 to 60 percent clay, 40 to 50 percent cobbles, and 15 to 25 percent gravel. Reaction is slightly acid or neutral.

The 2Bqm horizon is indurated throughout or is indurated in the upper few inches and weakly cemented to strongly cemented in the lower part. It has 30 to 40 percent cobbles and 20 to 30 percent gravel.

The 3C horizon has 40 to 50 percent cobbles and 20 to 30 percent gravel. It is sandy loam or loamy sand. Reaction is neutral or mildly alkaline.

Webfoot Series

The Webfoot series consists of deep, somewhat poorly drained soils on low terraces. These soils formed in mixed alluvium that is influenced by loess and volcanic ash in the surface layer. Slope is 0 to 7 percent. Elevation is 3,800 to 4,200 feet. The average annual precipitation is 16 to 24 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 50 to 90 days.

Typical pedon of Webfoot silt loam, 0 to 7 percent slopes, about 150 feet north and 75 feet east of the Mowich Loop Rest Area in Sumpter Valley, SE¼NW¼SW¼ sec. 16, T. 10 S., R. 38 E.

Oi—2 inches to 0; partially decomposed pine needles, grass, leaves, and twigs.

A1—0 to 6 inches; very dark brown (10YR 2/2) silt loam, grayish brown (10YR 5/2) dry; moderate very fine and fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine and few medium and coarse roots; many very fine tubular pores; about 10 percent gravel; mildly alkaline (pH 7.6); clear smooth boundary.

A2—6 to 13 inches; very dark grayish brown (10YR 3/2) gravelly loam, grayish brown (10YR 5/2) dry; common medium distinct yellowish brown (10YR 5/4) mottles; moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine and few medium and coarse roots; many very fine tubular pores; about 15 percent gravel; moderately alkaline (pH 8.2); clear smooth boundary.

Bw—13 to 25 inches; very dark grayish brown (10YR 3/2) gravelly sandy loam, grayish brown (10YR 5/2) dry; common medium distinct yellowish brown (10YR 5/4) mottles; moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine and few medium and coarse roots; many very fine and fine tubular pores; about 20 percent gravel and 5 percent cobbles; mildly alkaline (pH 7.6); gradual smooth boundary.

2Cg1—25 to 35 inches; olive gray (5Y 4/2) very gravelly sandy loam, light olive gray (5Y 6/2) dry; many coarse distinct yellowish brown (10YR 5/6) mottles; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine and medium roots; many very fine and fine irregular pores; about 30 percent gravel and 10 percent cobbles; mildly alkaline (pH 7.4); gradual smooth boundary.

2Cg2—35 to 48 inches; dark gray (5Y 4/1) extremely gravelly loamy sand, light gray (5Y 7/1) dry; many coarse distinct yellowish brown (10YR 5/6) mottles; single grain; loose, nonsticky and nonplastic; few fine and medium roots; many very fine and fine irregular pores; about 55 percent gravel and 10 percent cobbles; neutral (pH 7.2); gradual smooth boundary.

2Cg3—48 to 60 inches; multicolored extremely gravelly sand; single grain; loose, nonsticky and nonplastic.

The depth to bedrock is more than 60 inches. Reaction is moderately alkaline to neutral throughout the profile.

The A horizon has value of 2 or 3 when moist and 4 or 5 when dry and has chroma of 1 or 2 when moist or dry. It has 0 to 15 percent gravel and in some pedons has as much as 15 percent 2- to 4-millimeter concretions. The A2 horizon has few or common distinct mottles.

The Bw horizon has hue of 10YR or 2.5Y, value of 2 or 3 when moist and 4 or 5 when dry, and chroma of 0 to 2 when moist or dry. It has few to many distinct or prominent mottles. It is sandy loam or loam having 10 to 20 percent gravel and 0 to 5 percent cobbles.

The 2Cg horizon has hue of 5Y or 2.5Y, value of 4 or 5 when moist and 6 or 7 when dry, and chroma of 0 to 2 when moist or dry. It is sandy loam, loamy sand, or sand having 30 to 60 percent gravel and 10 to 20 percent cobbles.

Wingdale Series

The Wingdale series consists of deep, poorly drained soils on flood plains. These soils formed in mixed alluvium that is influenced by volcanic ash in the surface layer. Slope is 0 to 2 percent. Elevation is 2,200 to 3,400 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 110 to 140 days.

Typical pedon of Wingdale silt loam, 0 to 2 percent slopes, about 0.75 mile southeast of Keating and approximately 75 feet north of the Powder River, SW¼NW¼SW¼ sec. 16, T. 8 S., R. 42 E.

Ak1—0 to 6 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; moderate very fine subangular blocky structure parting to weak fine granular; soft, friable, slightly sticky and slightly plastic; many very fine and fine roots; common very fine and fine irregular pores; strongly effervescent; strongly alkaline (pH 8.6); clear smooth boundary.

Ak2—6 to 11 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; few fine distinct yellowish brown (10YR 5/4) mottles; moderate very fine and fine subangular blocky structure; soft, friable, slightly sticky and slightly plastic; many very fine and fine roots; common very fine and fine tubular pores; strongly effervescent; strongly alkaline (pH 8.6); clear smooth boundary.

Ak3—11 to 23 inches; very dark gray (10YR 3/1) silt loam, dark gray (10YR 4/1) dry; common fine distinct reddish brown (5YR 4/4) mottles; moderate very fine and fine subangular blocky structure; soft, friable, slightly sticky and slightly plastic; many very fine and fine roots; common very fine and fine tubular pores; slightly effervescent; moderately alkaline (pH 8.0); clear smooth boundary.

AC—23 to 34 inches; very dark grayish brown (10YR 3/2) silt loam, dark grayish brown (10YR 4/2) dry; many medium distinct reddish brown (5YR 4/4) mottles; moderate very fine and fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; common very fine and fine tubular pores; mildly alkaline (pH 7.8); gradual smooth boundary.

Cg1—34 to 49 inches; dark grayish brown (2.5Y 4/2) silty clay loam, grayish brown (2.5Y 5/2) dry; many medium distinct reddish brown (5YR 4/4) mottles; massive; slightly hard, firm, sticky and plastic; few fine roots; common very fine tubular pores; mildly alkaline (pH 7.6); gradual smooth boundary.

2Cg2—49 to 60 inches; dark gray (5Y 4/1) gravelly silty clay loam, gray (5Y 6/1) dry; common medium distinct light olive brown (2.5Y 5/4) mottles; massive; slightly hard, firm, sticky and plastic; few very fine tubular pores; about 20 percent gravel; mildly alkaline (pH 7.4).

The depth to bedrock is more than 60 inches. The mollic epipedon is more than 20 inches thick. The depth to mottles is 3 to 10 inches.

The A horizon has value of 2 or 3 when moist and 4 or 5 when dry and has chroma of 1 or 2 when moist or dry. Reaction is strongly alkaline or moderately alkaline.

The Cg1 and 2Cg2 horizons have hue of 10YR to 5Y, value of 4 or 5 when moist and 5 to 7 when dry, and chroma of 1 or 2 when moist or dry. They are silt loam or silty clay loam having 0 to 30 percent gravel.

Wingville Series

The Wingville series consists of deep, somewhat poorly drained soils on alluvial fans and broad alluvial terraces. These soils formed in mixed alluvium that is influenced by volcanic ash in the surface layer. Slope is 0 to 2 percent. Elevation is 2,200 to 3,600 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 110 to 140 days.

Typical pedon of Wingville silt loam, 0 to 2 percent slopes, about 1 mile south of Wingville, 600 feet south and 100 feet west of the center of sec. 34, T. 8 S., R. 39 E.

Ap—0 to 8 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; weak fine granular structure; soft, friable, slightly sticky and slightly plastic; many very fine and fine roots; common very fine and fine irregular pores; strongly effervescent; moderately alkaline (pH 8.4); gradual smooth boundary.

Ak1—8 to 18 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; moderate fine subangular blocky structure; soft, friable, slightly sticky and slightly plastic; many very fine and fine roots; common very fine and fine tubular pores; strongly effervescent; moderately alkaline (pH 8.0); clear smooth boundary.

Ak2—18 to 23 inches; very dark brown (10YR 2/2) silt loam, dark grayish brown (10YR 4/2) dry; few fine distinct reddish brown (5YR 4/4) mottles; weak fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; common very fine and fine tubular pores; strongly effervescent; moderately alkaline (pH 8.2); clear smooth boundary.

AC—23 to 33 inches; very dark grayish brown (10YR 3/2) silt loam, dark grayish brown (10YR 4/2) dry; common medium distinct reddish brown (5YR 4/4) mottles; weak medium and fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine roots; common very fine tubular pores; mildly alkaline (pH 7.8); abrupt smooth boundary.

C—33 to 40 inches; light brownish gray (10YR 6/2) silt loam, light gray (10YR 7/2) dry; massive; soft, friable, nonsticky and nonplastic; primarily volcanic ash; common fine roots; common very fine tubular pores; mildly alkaline (pH 7.8); abrupt smooth boundary.

Cg1—40 to 53 inches; olive gray (5Y 4/2) silty clay loam, gray (5Y 5/1) dry; many fine distinct reddish brown (5YR 5/4) mottles; massive; slightly hard, firm, sticky and plastic; few very fine tubular pores; neutral (pH 7.2); gradual smooth boundary.

2Cg2—53 to 60 inches; olive gray (5Y 4/2) gravelly silt loam, gray (5Y 5/1) dry; many fine distinct reddish brown (5YR 5/4) mottles; massive; slightly hard, firm, slightly sticky and slightly plastic; few fine tubular pores; about 25 percent gravel; neutral (pH 7.0).

The depth to bedrock is more than 60 inches. The mollic epipedon is 20 to 40 inches thick.

The A horizon has value of 2 or 3 when moist and 4 or 5 when dry and has chroma of 1 or 2 when moist or dry.

The C and 2C horizons have hue of 10YR to 5Y, value of 4 to 6 when moist and 5 to 7 when dry, and chroma of 1 or 2 when moist or dry. It is silt loam or silty clay loam and may be gravelly at a depth of more than 40 inches.

Xeric Torriorthents

These are very shallow to deep, well drained to excessively drained soils on steep canyon side slopes and terrace escarpments. They formed in colluvium and residuum derived from basalt, andesite, argillite, gabbro, and schist or in silty lacustrine sediments. Slope is 12 to 80 percent. Elevation is 2,000 to 4,000 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 100 to 140 days.

Typical pedon of Xeric Torriorthents, in an area of Rock outcrop-Xeric Torriorthents-Darkcanyon complex, 50 to 80 percent south slopes, in the Deer Creek drainage adjacent to the Burnt River Canyon, NE¼SE¼SE¼ sec. 25, T. 11 S., R. 41 E.

A—0 to 16 inches; grayish brown (10YR 5/2) extremely channery loam, light gray (10YR 7/2) dry; weak very fine subangular blocky structure; loose, very friable, nonsticky and nonplastic; many fine and few medium roots; many fine tubular pores; about 60 percent channers and 20 percent flagstones; mildly alkaline (pH 7.6); clear wavy boundary.

C—16 to 34 inches; pale brown (10YR 6/3) extremely channery sandy loam, very pale brown (10YR 7/3) dry; weak very fine subangular blocky structure; loose, very friable, nonsticky and nonplastic; common fine and few medium roots; many fine pores; about 70 percent channers and 15 percent flagstones; mildly alkaline (pH 7.4); abrupt wavy boundary.

R—34 inches; highly fractured schist.

The depth to hard bedrock is 8 to more than 60 inches. In some areas the depth to soft bedrock is 3 to 20 inches. The texture is clay to loamy sand having 35 to 60 percent channers, 15 to 30 percent flagstones, 60 to 85 percent stones or cobbles, and 0 to 30 percent gravel.

The A horizon has hue of 10YR, 2.5Y, or 5Y, value of 2 to 6 when moist and 4 to 7 when dry, and chroma of 2 to 4 when moist or dry.

Xerorthents

These are very shallow to deep, well drained to somewhat excessively drained soils on hills. They formed in colluvium and residuum derived from schist. Slope is 35 to 80 percent. Elevation is 4,000 to 5,300 feet. The average annual precipitation is 12 to 16 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 70 to 100 days.

Typical pedon of Xerorthents, in an area of Rock outcrop-Lostbasin-Xerorthents complex, 50 to 80 percent south slopes, in the Deer Creek drainage adjacent to the Burnt River Canyon, NE¼SE¼SE¼ sec. 22, T. 11 S., R. 41 E.

A—0 to 14 inches; grayish brown (10YR 5/2) extremely channery loam, light gray (10YR 7/2) dry; weak very fine subangular blocky structure; loose, nonsticky and nonplastic; many fine and few medium roots; many fine tubular pores; about 70 percent channers and 10 percent flagstones; neutral (pH 7.2); clear wavy boundary.

C—14 to 29 inches; yellowish brown (10YR 5/4) extremely channery loam, very pale brown (10YR 7/3) dry; weak very fine subangular blocky structure; loose, very friable, slightly sticky and slightly plastic; many fine and few medium roots; many fine tubular pores; about 60 percent channers and 20 percent flagstones; neutral (pH 6.8); abrupt wavy boundary.

R—29 inches; highly fractured schist.

The depth to hard bedrock is 5 inches to more than 60 inches. The texture is silt loam to loamy sand having 50 to 60 percent channers and 5 to 35 percent flagstones.

The A horizon has hue of 10YR, 7.5YR, 2.5Y or 5Y, value of 2 to 5 when moist and 4 to 7 when dry, and chroma of 2 to 4 when moist or dry.

Formation of the Soils

By Gerald D. Macdonald, soil scientist, Natural Resources Conservation Service.

Soil is material on the earth's surface that contains living matter and is capable of supporting plants (*5*). The nature of a soil depends upon the combination and interaction of five factors—climate, plant and animal life, parent material, topography, and time.

The relative influence of each factor varies from place to place, and in some places a single factor can determine most properties of the soil. Parent material, climate, and topography are responsible for most differences in the soils in the survey area and are described together in this section under "Geomorphic Surfaces and Soil Development." The soil-forming factors of climate and plant and animal life are described separately.

Climate

Climate, particularly moisture and temperature, greatly influences soil formation. The chemical and physical reactions taking place in the soil are largely controlled by climate. Water dissolves soluble material in the soil and transports material from one part of the soil to another. Water is necessary for the growth of plants and soil organisms that contribute organic matter to the soil.

Temperature affects the rate of chemical reactions and of physical breakdown caused by the freezing of water. Freezing and thawing of water causes expansion and contraction and influences the movement of soil particles and rock fragments in the soil. The kind and amount of living organisms in and on the soil determine the kind and amount of organic matter added to the soil. The rate of decomposition of organic matter is controlled by temperature and moisture.

Five major moisture and temperature zones in the survey area greatly influence soil genesis.

Zone 1. Summers are hot and dry, and winters are cold and dry. The growing season is long; plant growth begins in early spring and continues through midsummer. Elevation ranges from 2,000 to 4,000 feet, and the annual precipitation range is about 9 to 12 inches. The soils in this zone have an aridic moisture regime and a mesic soil temperature regime (*26*). The soils in zone 1 dominantly are in general soil map units 1, 2, 3, 6, 7, 11, 12, and 13.

On young surfaces in this zone, such as nearly level low stream terraces and flood plains that have a high water table, the soils are moist for long periods. This allows for abundant plant growth and organic matter accumulation. Under these conditions, Haploxerolls and Haplaquolls have formed. Where salts have accumulated, Haplaquepts and Halaquepts have formed.

On older surfaces, such as terraces and foothills, Camborthids, Aridic Haploxerolls, and Torriorthents have formed. On the oldest surfaces where the soil-forming factors have been active for long periods, Aridic Argixerolls, Durargids, and Aridic Palexerolls have formed.

Zone 2. Summers are cool and dry, and winters are cold and dry. The growing season is shorter than in warmer areas at lower elevations. The soils in this zone have an aridic moisture regime and a frigid soil temperature regime (*26*). Elevation ranges from 3,800 to 4,400 feet, and the annual precipitation is about 9 to 12 inches. The soils in this zone are in old lacustrine sediments where the soil-forming factors have been active for long periods. Haplargids and Aridic Argixerolls have formed. Most of the soils are in general soil map unit 8.

Zone 3. Summers are warm and dry, and winters are cold and moist. The growing season is long; plant growth begins in late spring and continues through late summer. The soils in this zone have a xeric moisture regime and a mesic soil temperature regime (*26*). Elevation ranges from 2,000 to 4,000 feet, and the annual precipitation is about 12 to 22 inches. The soils are mainly in general soil map units 4, 10, 14, and 15 and on the south slopes of unit 16.

On young surfaces in this zone, such as low stream terraces and flood plains that are nearly level and have a high water table, Haploxerolls and Haplaquolls have formed. On older surfaces, such as terraces and hills where the soil-forming factors have been active for long periods, Argixerolls, Durixerolls, and Palexerolls have formed.

Zone 4. Summers are cool and dry, and winters are cold and wet. The growing season is shorter than in warmer areas at lower elevations. The soils in this zone have a xeric moisture regime and a frigid soil temperature regime (*26*). Elevation ranges 3,300 to 6,200 feet, and the annual precipitation is about 12 to 35 inches. The soils in this zone are on high terraces, rolling hills, canyons. The vegetation is contrasting, depending on the combinations of soils and topography of the landform.

On the younger, active surfaces in this zone, where soil formation is minimal, Haploxerolls, Xerochrepts, and Vitrandepts have formed. On the older, stable surfaces, where the soil-forming factors have been active for long periods, Argixerolls, Durixerolls, and Palexerolls have formed.

Zone 5. Summers are cool and moist, and the growing season is very short in comparison with the growing seasons in zones at lower elevations. Winters are cold and wet and are characterized by much snowfall. The soils in this zone have a xeric moisture regime and a cryic soil temperature regime (*26*). The elevation is greater than 6,200 feet, and the annual precipitation is greater than 30 inches. This zone is typified by active surfaces on steep mountains where Cryandepts and Cryochrepts have formed.

Living Organisms

Living organisms, especially the higher-order plants, are active in soil formation. The changes they bring about depend mainly on the life processes of each kind of organism. The kinds of organisms that live on and in the soil are determined, in turn, by climate, parent material, topography or relief, and age of the soil. In this survey area, the effects of climate on vegetation are dominant in soil formation.

Plants provide a cover that helps to help to control erosion and stabilize the surface. Leaves, twigs, roots, and remains of entire plants accumulate on the surface of soils and are decomposed by micro-organisms, earthworms, and other soil fauna. Plant roots widen cracks in the underlying rock, permitting water to penetrate. The uprooting of trees by wind also mixes soil layers and loosens the underlying material. Organisms enhance important processes, such as organic matter accumulation, profile mixing, nutrient cycling, stabilization of soil structure, and addition of nitrogen.

In Baker County, the soils formed under two major types of plant cover: Grasses and shrubs are dominant in the warmer and more dry areas, and conifer forests are dominant in the cooler and more moist areas.

Small animals, earthworms, insects, and micro-organisms influence the formation of soils in several ways. They mix organic matter into the mineral soil material and accelerate the decomposition of organic matter by breaking down the remains of plants. Small animals burrow into the soil and mix the layers. Earthworms and other small invertebrates feed on the organic matter in the upper few inches of soil material. They slowly but continually mix the soil material and can alter its chemistry. Bacteria, fungi, and other micro-organisms hasten the weathering of rocks and the decomposition of organic matter.

Conditions in the survey area are generally favorable for many organisms. Earthworms are common in all areas except the cooler frigid and cryic soil temperature zones (*26*). Small animals, such as gophers, moles, and ground squirrels, are common throughout the survey area. Humans have also played a role by modifying soils in some areas, such as by dredging in the Sumpter area, land leveling for farming in the Eagle and Baker Valleys, and placer mining along the Burnt River.

Geomorphic Surfaces and Soil Development

Geomorphic surfaces consist of a landform or group of landforms that represent an episode of landscape development. These surfaces have been extensively studied and mapped along the Willamette Valley (*20*), in central Washington (*14*), and in the Idaho Panhandle (*21*).

Radiocarbon dating provided estimates of the ages for alluvium underlying mid-to-early Holocene surfaces in the Willamette Valley (*5*), central Washington (*14*), and the Idaho Panhandle (*21*). These ages helped to establish a time sequence for geomorphic surfaces in Oregon, Washington, and Idaho. Geomorphic surfaces were also studied and mapped in Multnomah and Columbia Counties (*29, 30*). Geomorphic surfaces on the Oregon Coast have been studied (*18*), as have the terraces along the Pacific Coast in order to determine whether the terraces could be correlated regionally (*19*). These studies help to confirm and substantiate the regional occurrence of geomorphic surfaces in Oregon and are used to correlate the surfaces identified on in Baker County.

In general, the major result of these studies is that soil development increases as the age of the landscape increases. The kind of soil associated with a surface in this relationship is the result of the interaction of parent material, climate, and living organisms since the time factor of soil genesis is considered a constant.

The sequence of surfaces recognized in Baker County, in order of increasing age, are Horseshoe, Ingram, Winkle, Senecal, Dolph, and Eola (fig. 14). Also described here, but not considered a geomorphic

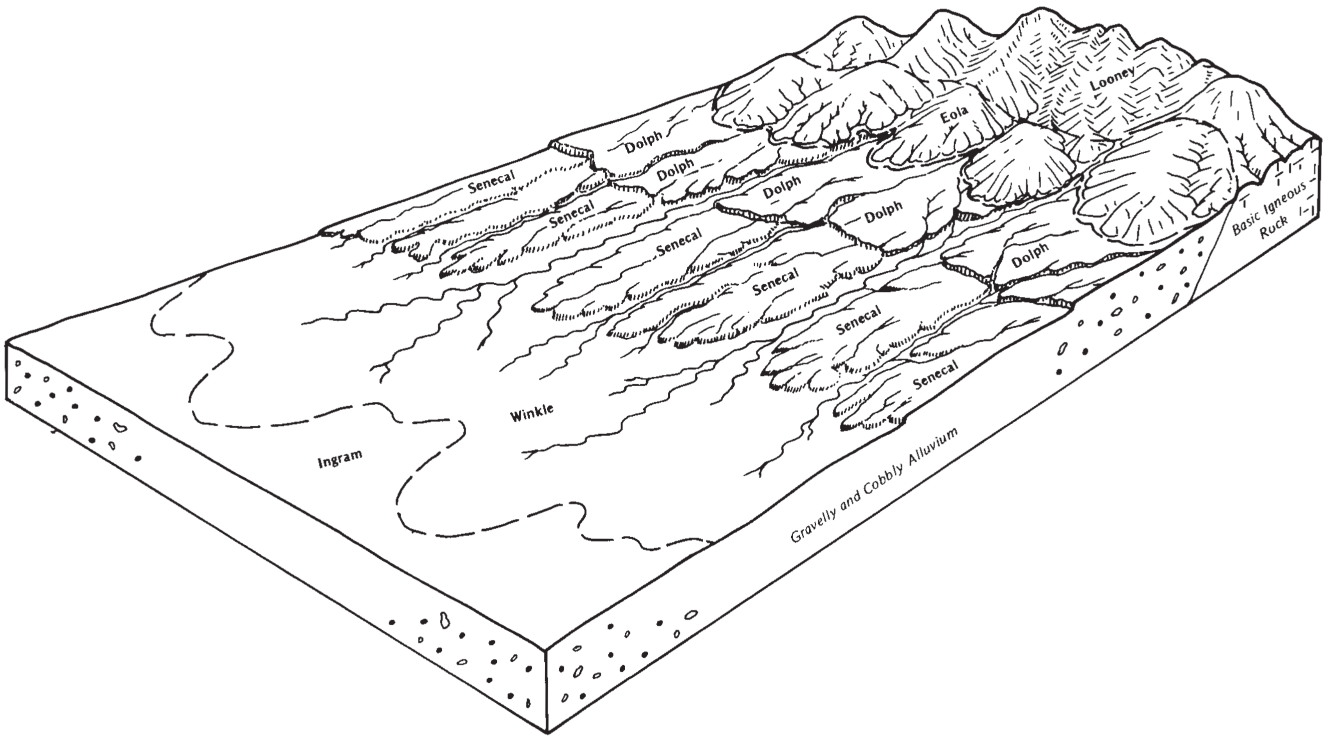

Figure 14.—Typical sequence of geomorphic surfaces in Baker County.

surface, is the Looney geomorphic map unit, which consists of steep, broken uplands throughout the survey area. Because of the variability in landscape stability in the Looney unit, the soils and surfaces in it fit no particular span of time.

No detailed geomorphic mapping has been done in Baker County, but the geomorphic surfaces described have been identified by field investigation. Other landforms may be identified during a detailed geomorphic study.

Horseshoe.—This surface is the lower of the two flood plains of the Burnt, North Powder, and Powder Rivers and Eagle and Pine Creeks. Flooding can occur annually. This surface has low relief and includes the river channel, the point bar deposits, the channel fillings, and the abandoned meanders. The surface is commonly underlain by sand and gravel. Many areas support young stands of deciduous trees and shrubs, while others are devoid of vegetation. Rapid changes in the Horseshoe landscape result from the cutting of new channels, the abandonment of older channels, the lateral migration of meanders, and the downstream movement of alluvial deposits. The Horseshoe surface probably began to develop after the settlement of the county began.

The Horseshoe surface is characterized mainly by Riverwash. In some places there are inclusions of Fluventic Haploxerolls supporting vegetation.

Ingram.—This surface is the higher of the two flood plains in the survey area. The topography of the Ingram surface is typically undulating, and as much as 4 feet of relief is produced by overbank channeling during flood stage. The bars and channels have an approximate orientation parallel to the stream.

This surface commonly is subject to flooding; elevation is generally between 2,000 and 4,200 feet. The surface geomorphically occurs between the Winkle and Horseshoe surfaces and is considered late Holocene in age. Alluvium underlying the Ingram surface consists of sand, gravel, and cobbles near the Horseshoe surface and becomes finer textured near the Winkle surface.

The horizon development in the soils on the Ingram surface is limited to accumulation of organic matter. Cumulic Haplaquolls are the dominant soils on this surface and are represented by the Boyce, Catherine, Hershal, and Wingdale soils. These soils have a mollic epipedon and an irregular decrease in organic matter content as depth increases. The mollic epipedon rests directly on a C horizon that is too little altered to be called a cambic horizon. Typic Haplaquepts, such as the Baldock soils, are common on this surface.

Other soils associated with the Ingram geomorphic surface are Fluvaquentic Haploxerolls such as the Balm and Damore soils, Cumulic Cryaquolls such as the Silvies soils, Typic Cryaquolls such as the Stovepipe soils, and Cumulic Haploxerolls.

Winkle—.This surface is the oldest related to the present drainage systems in the survey area. Most of this surface has morphology typical of abandoned flood plains of aggrading streams and reflects a bar and channel topography with a defined backswamp in some areas. Relief between bars and channels results largely from the competence of the stream that flowed through the area. Elevation is generally between 2,000 and 4,200 feet. The surface geomorphically occurs between the Senecal and Ingram surfaces and is considered middle to early Holocene age. Sediment associated with the Winkle surface is dominated by silt and clay and is commonly underlain by stratified sand and gravel at a depth of 2 to 6 feet. In some places the Winkle surface contains strata of volcanic ash from the eruption of Mt. Mazama (Crater Lake).

Horizon development in soils on the Winkle surface is mainly limited to accumulation of organic matter as evidenced by mollic epipedons. Some soils on this surface exhibit a cambic horizon, which is an indication of greater soil development compared to that on the Ingram surface. The organic matter in the profile has resulted from pedogenesis rather than being inherited from alluvial deposition.

Pachic Haploxerolls are the dominant soils on this surface. These are the La Grande, Langrell, Powval, Webfoot, and Wingville soils. Another group of soils on the Winkle surface is the salt-affected Typic Halaquepts, such as the Umapine and Burkemont soils. The Winkle surface also includes Entic Haploxerolls on alluvial fans, such as the Goodrich and Benderly soils.

Other soils associated with the Winkle geomorphic surface are Cumulic Haploxerolls such as the Jett soils and Aquic Haploxerolls such as the Sumpley soils.

Senecal.—This surface occurs as older terraces and fan terraces adjacent to major streams in the survey area. It is above the general level of valley floors and is the lowest terrace not related to the present drainage system. Topography of the Senecal surface is variable throughout the survey area. The most extensive area of the surface exhibits low relief and slight incision by drainageways. Other less extensive areas have greater relief; slopes are as much as 35 percent, and drainageways are deep. Elevation is generally between 2,000 and 4,400 feet.

This surface is geomorphically between the Dolph and Winkle surfaces and is considered late Pleistocene age. Sediment associated with the Senecal surface is dominated by silt and clay, but it includes sandy to gravelly material in some areas. The material probably originated from lacustrine and glaciofluvial deposits. Some deposits interpreted as terrace or flood plain pebbles may be attributable to glaciation. The deposits involve a great variety of rock types and are composed largely of unsorted material ranging in size from silt to boulders.

Xerollic Camborthids are the dominant soils on the Senecal surface. Burntriver, Legler, and Oxman soils represent this group. Horizon development in these soils is limited to the formation of a cambic horizon and accumulation of carbonates in the substratum.

Other soils on the Senecal surface include Haploduridic Durixerolls such as the Baker soils, salt-affected Typic Halaquepts such as the Stanflow soils, and Typic Haploxererts such as the Halfway soils.

Dolph.—The Dolph surface is the second oldest geomorphic surface in the survey area. This surface occurs as remnants of extensive flats that have been dissected to form rolling topography above the main valley floor. Landforms consist of a complex group of terraces, old lake beds, and pediments (*7*). The Dolph surface is considered to be middle Pleistocene (*18*) because of its position on the landscape and the degree of weathering of underlying materials. Elevation is generally 2,300 to 4,400 feet. This surface occurs between the Eola and Senecal surfaces. It typically has slopes of 2 to 35 percent but may be as steep as 50 percent in some areas.

The Dolph surface in Baker County is typified by the Barnard, Encina, Marack, McEwen, and Virtue soils. The soils on this surface exhibit stronger development than the soils on younger geomorphic surfaces in the survey area, partly because the soils on the Dolph surface are older. Argiduridic Durixerolls, such as the Barnard soils, and Xeric Argidurids, such as the Virtue soils, have a well developed argillic horizon and accumulations of carbonates above a well developed duripan. Aridic Calcic Argixerolls, such as the Encina and Marack soils, have a well developed argillic horizon and accumulations of carbonates in the subsoil.

Other soils associated with the Dolph geomorphic surface are Ultic Argixerolls, such as the Applegate soils, and Pachic Argixerolls, such as the Nagle soils. Most of the soils on this surface overlie lithologic discontinuities composed of stratified alluvium or tuffaceous sediments.

Eola.—The Eola surface is the oldest stable geomorphic surface in the survey area. This surface consists of remnants of extensive flats that have been dissected to form rolling topography. Landforms consist of high terraces, fan terraces, and pediments. The Eola surface is considered early Pleistocene and was probably quite extensive. However, late Pleistocene and Holocene erosion removed much of this surface, and only small remnants remain. Elevation ranges from 2,200 to 5,000 feet. Typically, Eola remnants have gently sloping tops and highly dissected side slopes of 12 to 60 percent. This surface is well expressed by the high terraces north of Dooley Mountain, south of Unity, and northwest of Richland.

The Eola surface in Baker County is typified by Hibbard, Rastus, Wahstal, Campcreek, Simas, and Skullgulch soils. The soils on this geomorphic surface exhibit much stronger development than the soils on other geomorphic surfaces in the survey area because of the greater age of the surface and, therefore, the time available for pedogenesis. The gently sloping tops of this surface are represented by Palexerollic Durixerolls, such as Hibbard, Rastus, and Wahstal soils. These soils are clayey and have a strongly developed argillic horizon and an abrupt upper boundary overlying an indurated, massive duripan. The side slopes are represented by Aridic, Typic, and Pachic Palexerolls, such as Simas, Campcreek, and Skullgulch soils, respectively. These soils are clayey and have a strongly developed argillic horizon and an abrupt upper boundary. All of the soils on this surface have an absolute increase in content of clay of 15 to 30 percent between the BA and 2Bt horizons. Many soils have accumulations of carbonates in the subsoil.

Other soils associated with the Eola surface are Aridic Argixerolls, such as Hyall soils, and Xeric Paleargids, such as Poall soils. These soils are associated with terrace remnants.

Looney unit.—This unit has no particular age connotation and, therefore, is not considered a geomorphic surface. The topography is completely dissected and dominantly steeply sloping. Slope gradient exceeds 100 percent in places. The steep, broken topography may join any other two surfaces, or it may make up large areas of mountain terrain so thoroughly dissected that a geomorphic surface is not recognized. Erosion is active in much of the Looney unit, and in some areas mass movement is evident. In some other areas, however, occasional remnants of some older geomorphic surfaces are present.

The variability in age makes the Looney unit useful in mapping areas of mountainous terrain. The unit in Baker County represents a vast cross section of geologic history and parent materials. It includes the basalt canyons in the east half of the county, the intrusive and extrusive igneous rock in the areas of Lookout Mountain, North Elkhorn Mountain, and Pedro Mountain, and the uplifted marine sediments intermixed with submarine volcanics of the Burnt River Canyon, South Elkhorn Mountains, and uplands south of Pedro Mountain.

The Looney unit can be divided into several smaller geomorphic surfaces if the scale in mapping is detailed enough. Three significant gradient breaks have been recognized in the survey area and correspond to active, metastable, and stable slopes (*18*).

In general, soils exhibiting the least amount of soil development formed on the active slopes, soils exhibiting stronger development formed on the metastable slopes, and those soils exhibiting the strongest soil development formed on stable slopes. In this unit, parent material and topography are the dominant soil-forming factors. Differences between active, metastable, and stable slopes are reflected by the composition of the parent material and the slope gradients.

The active slopes are typified by soils formed in quartz diorite, rhyolite, schist, and argillite on slopes greater than 35 percent. Soils on active slopes generally show very little soil development, are sandy or loamy, have a high content of rock fragments, and show volcanic ash influence in the surface layer. Soils associated on active slopes are Typic Xerochrepts, such as the Lostbasin, Segundo, and Stavely soils; Typic Vitrixerands, such as the Brannan, Crackler, Rouen, Stices, and Tolo soils; and Vitrandic Xerochrepts, such as the Highhorn, Huntrock, and Inkler soils. Other soils with active slopes are Lithic Xeric Torriorthents, such as the Snaker soils, Typic Vitricryands, such as the Eaglecap soils and the Angelpeak soils.

The metastable slopes are typified by soils formed in basalt, metamorphosed diorite, and bedrock of the Strawberry Volcanics. Slopes range from 35 to 70 percent but are typically less than 50 percent. Soils on metastable slopes express moderate to strong development, are loamy or clayey, and have a high content of rock fragments.

Soils associated with metastable slopes include Haploxerolls and Argixerolls. Haploxerolls are the Anatone, Bakeoven, Baldridge, Brownscombe, Chambeam, Derringer, Dogtown, Emily, Fivebit, Greenscombe, Hall Ranch, Kahler, Kilmerque, Lickskillet, Lovline, McGarr, Piersonte, Rockly, Shangland, Sinker, and Taterpa soils. Argixerolls are the Ateron, Brownlee, Clovercreek, Copperfield, Gwinly, Harlow, Immig, Keating, Klicker, Ladd, Longbranch, Morningstar, Robinette, Roostercomb, Ruckles, Ruclick, Sag, Snell, Snellby, and Top soils.

The stable slopes are typified by soils formed in basalt, volcanic tuff, and volcanic rock of the Clarno Formation. Slopes range from 1 to 35 percent but are typically less than 20 percent. Soils on stable slopes express strong soil development, are clayey, and reflect an absence of rock fragments within the profile. Soils associated with stable slopes are Vertic Argixerolls, such as the Ukiah soils, Ultic Palexerolls, such as the Hankins soils, Xeric Argidurids, such as the Lookout soils, Xeric Haplargids, such as the Glasgow soils, Pachic Palexerolls, such as the Ridley soils, and Typic Palexerolls, such as the Pritchard soils.

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Glossary

Ablation till. Loose, permeable till deposited during the final downwasting of glacial ice. Lenses of crudely sorted sand and gravel are common.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alkali (sodic) soil. A soil having so high a degree of alkalinity (pH 8.5 or higher), or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Alluvial cone. The material washed down the sides of mountains and hills by ephemeral streams and deposited at the mouth of gorges in the form of a moderately steep, conical mass descending equally in all directions from the point of issue.

Alluvial fan. The fanlike deposit of a stream where it issues from a gorge upon a plain or of a tributary stream near or at its junction with its main stream.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Andesite. A fine-grained extrusive igneous rock intermediate in composition between basalt and rhyolite; generally exhibits larger crystals in a finer ground mass.

Animal-unit-month (AUM). The amount of forage required by one mature cow of approximately 1,000 pounds weight, with or without a calf, for 1 month.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Arroyo. The flat-floored channel of an ephemeral stream, commonly with very steep to vertical banks cut in alluvium.

Association, soil. A group of soils or miscellaneous areas geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—Inches

Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	More than 12

Back slope. The geomorphic component that forms the steepest inclined surface and principal element of many hillsides. Back slopes in profile are commonly steep, are linear, and may or may not include cliff segments.

Backswamp (flood plain landform). Extensive marshy, depressional area of the flood plain; between the natural levee borders of channel belts and thwe valley sides or terraces.

Badland. Steep or very steep, commonly nonstony, barren land dissected by many intermittent drainage channels. Badland is most common in semiarid and arid regions where streams are entrenched in soft geologic material. Local relief generally ranges from 25 to 500 feet. Runoff potential is very high, and geologic erosion is active.

Bajada. A broad alluvial slope extending from the base of a mountain range out into a basin and formed by coalescence of separate alluvial fans.

Bar and channel. The microrelief common to flood plains and relatively young alluvial terraces. Over time, the microrelief becomes subdued as the higher bars erode into the channels. The ridge-like bars commonly consist of accumulations of coarse sediment, but the larger channels are finer textured.

Basal area. The area of a cross section of a tree, generally referring to the section at breast height and measured outside the bark. It is a measure of stand density, commonly expressed in square feet.

Basal till. Compact glacial till deposited beneath the ice.

Base saturation. The degree to which material having cation exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation exchange capacity.

Bedding planes. Fine strata, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediment.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bench terrace. A raised, level or nearly level strip of earth constructed on or nearly on a contour, supported by a barrier of rocks or similar material, and designed to make the soil suitable for tillage and to prevent accelerated erosion.

Bisequum. Two sequences of soil horizons, each of which consists of an illuvial horizon and the overlying eluvial horizons.

Blowout. A shallow depression from which all or most of the soil material has been removed by wind. A blowout has a flat or irregular floor formed by a resistant layer or by an accumulation of pebbles or cobbles. In some blowouts the water table is exposed.

Bottom land. The normal flood plain of a stream, subject to flooding.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Breaks. The steep to very steep broken land at the border of an upland summit that is dissected by ravines.

Breast height. An average height of 4 ½ feet above the ground surface; the point on a tree where diameter measurements are ordinarily taken.

Breccia. A coarse grained clastic rock composed of angular fragments (more than 2 mm in diameter) commonly cemented together in a fine grained matrix of varying composition and origin. The consolidated equivalent of rubble.

Broad-base terrace. A ridge-type terrace built to control erosion by diverting runoff along the contour at a nonscouring velocity. The terrace is 10 to 20 inches high and 15 to 30 feet wide and has gently sloping sides, a rounded crown, and a dish-shaped channel along the upper side. It may be nearly level or have a grade toward one or both ends.

Brush management. Use of mechanical, chemical, or biological methods to reduce or eliminate competition of woody vegetation to allow understory grasses and forbs to recover, or to make conditions favorable for reseeding. It increases production of forage, which reduces erosion. Brush management may improve the habitat for some species of wildlife.

Butte. An isolated small mountain or hill with steep or precipitous sides and a top variously flat, rounded, or pointed that may be a residual mass isolated by erosion or an exposed volcanic neck.

Cable yarding. A method of moving felled trees to a nearby central area for transport to a processing facility. Most cable yarding systems involve use of a drum, a pole, and wire cables in an arrangement similar to that of a rod and reel used for fishing. To reduce friction and soil disturbance, felled trees generally are reeled in while one end is lifted or the entire log is suspended.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Caliche. A more or less cemented deposit of calcium carbonate in soils of warm-temperate, subhumid to arid areas. Caliche occurs as soft, thin layers in the soil or as hard, thick beds just beneath the solum, or it is exposed at the surface by erosion.

California bearing ratio (CBR). The load-supporting capacity of a soil as compared to that of a standard crushed limestone, expressed as a ratio. First standardized in California. A soil having a CBR of 16 supports 16 percent of the load that would be supported by standard crushed limestone, per unit area, with the same degree of distortion.

Canopy. The leafy crown of trees or shrubs. (See Crown.)

Canyon. A long, deep, narrow, very steep sided valley with high, precipitous walls in an area of high local relief.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Catena. A sequence, or "chain," of soils on a landscape that formed in similar kinds of parent material but have different characteristics as a result of differences in relief and drainage.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity, but is more precise in meaning.

Catsteps. Very small, irregular terraces on steep hillsides, especially in pasture, formed by the trampling of cattle or the slippage of saturated soil.

Cement rock. Shaly limestone used in the manufacture of cement.

Channery soil. A soil that is, by volume, more than 15 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches along the longest axis. A single piece is called a channer.

Chemical treatment. Control of unwanted vegetation by use of chemicals.

Chiseling. Tillage with an implement having one or more soil-penetrating points that loosen the subsoil and bring clods to the surface. A form of emergency tillage to control soil blowing.

Cirque. Semicircular, concave, bowllike areas that have steep faces primarily resulting from glacial ice and snow abrasion.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter, in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Clay skin. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay film.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Climax plant community. The plant community on a given site that will be established if present environmental conditions continue to prevail and the site is properly managed.

Coarse fragments. Mineral or rock particles larger than 2 millimeters in diameter.

Coarse textured soil. Sand or loamy sand.

Cobble (or cobblestone). A rounded or partly rounded fragment of rock 3 to 10 inches (7.6 to 25 centimeters) in diameter.

Cobbly soil material. Material that is 15 to 35 percent, by volume, rounded or partially rounded rock fragments 3 to 10 inches (7.5 to 25 centimeters) in diameter. Very cobbly soil material is 35 to 60 percent of these rock fragments, and extremely cobbly soil material is more than 60 percent.

Colluvium. Soil material, rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil or miscellaneous areas in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas.

Compressible (in tables). Excessive decrease in volume of soft soil under load.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Congeliturbate. Soil material disturbed by frost action.

Conglomerate. A coarse grained, clastic rock composed of rounded to subangular rock fragments more than 2 millimeters in diameter. It commonly has a matrix of sand and finer material. Conglomerate is the consolidated equivalent of gravel.

Conservation cropping system. Growing crops in combination with needed cultural and management practices. If soil improving crops and practices used in the system more than offset the soil depleting crops and deteriorating practices, then it is a good conservation cropping system. Cropping systems are needed on all tilled soils. Soil improving practices in a conservation cropping system include the use of rotations that contain grasses and legumes and the return of crop residue to the soil. Other practices include the use of green manure crops of grasses and legumes, proper tillage, adequate fertilization, and weed and pest control.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—Readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—Adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping (or contour farming). Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Coppice dune. A small dune of fine-grained soil material stabilized around shrubs or small trees.

Coprogenous earth (sedimentary peat). Fecal material deposited in water by aquatic organisms.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Crop residue management. Returning crop residue to the soil, which helps to maintain soil structure, organic matter content, and fertility and helps to control erosion.

Cropping system. Growing crops using a planned system of rotation and management practices.

Cross-slope farming. Deliberately conducting farming operations on sloping farmland in such a way that tillage is across the general slope.

Crown. The upper part of a tree or shrub, including the living branches and their foliage.

Cuesta. An asymmetric, homoclinal ridge capped by resistant rock layers of slight to moderate dip.

Culmination of the mean annual increment (CMAI). The average annual increase per acre in the volume of a stand. Computed by dividing the total volume of the stand by its age. As the stand increases in age, the mean annual increment continues to increase until mortality begins to reduce the rate of increase. The point where the stand reaches its maximum annual rate of growth is called the culmination of the mean annual increment.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Decreasers. The most heavily grazed climax range plants. Because they are the most palatable, they are the first to be destroyed by overgrazing.

Deferred grazing. Postponing grazing or arresting grazing for a prescribed period.

Delta. A body of alluvium whose surface is nearly flat and fan shaped, deposited at or near the mouth of a river or stream where it enters a body of relatively quiet water, generally a sea or lake.

Dense layer (in tables). A very firm, massive layer that has a bulk density of more than 1.8 grams per cubic centimeter. Such a layer affects the ease of digging and can affect filling and compacting.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Desert pavement. A layer of gravel or coarser fragments on a desert soil surface that was emplaced by upward movement of fragments from underlying sediment or remains after finer particles have been removed by running water or wind.

Dip slope. A slope of the land surface, roughly determined by and approximately conforming with the dip of underlying bedded rock.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Divided-slope farming. A form of field stripcropping in which crops are grown in a systematic arrangement of two strips, or bands, across the slope to reduce water erosion. One strip is in a close-growing crop that provides protection from erosion, and the other strip is in a crop that provides less protection from erosion. This practice is used where slopes are not long enough to permit a full stripcropping pattern to be used.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—These soils have very high and high hydraulic conductivity and low water holding capacity. They are not suited to crop production unless irrigated.

Somewhat excessively drained.—These soils have high hydraulic conductivity and low water holding capacity. Without irrigation, only a narrow range of crops can be grown and yields are low.

Well drained.—These soils have intermediate water holding capacity. They retain optimum amounts of moisture, but they are not wet close enough to the surface or long enough during the growing season to adversely affect yields.

Moderately well drained.—These soils are wet close enough to the surface or long enough that planting or harvesting operations or yields of some field crops are adversely affected unless artificial drainage is provided. Moderately well drained soils commonly have a layer with low hydraulic conductivity, a wet layer relatively high in the profile, additions of water by seepage, or some combination of these.

Somewhat poorly drained.—These soils are wet close enough to the surface or long enough that planting or harvesting operations or crop growth is markedly restricted unless artificial drainage is provided. Somewhat poorly drained soils commonly have a layer with low hydraulic conductivity, a wet layer high in the profile, additions of water through seepage, or a combination of these.

Poorly drained.—These soils commonly are so wet at or near the surface during a considerable part of the year that field crops cannot be grown under natural conditions. Poorly drained conditions are caused by a saturated zone, a layer with low hydraulic conductivity, seepage, or a combination of these.

Very poorly drained.—These soils are wet to the surface most of the time. They are wet enough to prevent the growth of important crops (except rice) unless artificially drained.

Drainage, surface. Runoff, or surface flow of water, from an area.

Draw. A small stream valley, generally more open and with broader bottom land than a ravine or gulch.

Drumlin. A low, smooth, elongated oval hill, mound, or ridge of compact glacial till. The longer axis is parallel to the path of the glacier and commonly has a blunt nose pointing in the direction from which the ice approached.

Duff. A term used to identify a generally firm organic layer on the surface of mineral soils. It consists of fallen plant material that is in the process of decomposition and includes everything from the litter on the surface to underlying pure humus.

Ecotone. The area influenced by the transition between plant communities.

Edge. The place where plant communities meet or where successional stages or vegetative conditions within plant communities come together.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Ephemeral stream. A stream, or reach of a stream, that flows only in direct response to precipitation. It receives no long-continued supply from melting snow or other source, and its channel is above the water table at all times.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature; for example, fire that exposes the surface.

Erosion pavement. A layer of gravel or stones that remains on the surface after fine particles are removed by sheet or rill erosion.

Escarpment. A relatively continuous and steep slope or cliff breaking the general continuity of more gently sloping land surfaces and produced by erosion or faulting. Synonym: scarp.

Esker (geology). A narrow, winding ridge of stratified gravelly and sandy drift deposited by a stream flowing in a tunnel beneath a glacier.

Excess alkali (in tables). Excess exchangeable sodium in the soil. The resulting poor physical properties restrict the growth of plants.

Excess fines (in tables). Excess silt and clay in the soil. The soil does not provide a source of gravel or sand for construction purposes.

Excess lime (in tables). Excess carbonates in the soil that restrict the growth of some plants.

Excess salts (in tables). Excess water-soluble salts in the soil that restrict the growth of most plants.

Excess sulfur (in tables). Excessive amount of sulfur in the soil. The sulfur causes extreme acidity if the soil is drained, and the growth of most plants is restricted.

Extrusive rock. Igneous rock derived from deep-seated molten matter (magma) emplaced on the earth's surface.

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grain is grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Fan terrace. A relict alluvial fan, no longer a site of active deposition, incised by younger and lower alluvial surfaces.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fibric soil material (peat). The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fill slope. A sloping surface consisting of excavated soil material from a road cut. It commonly is on the downhill side of the road.

Fine textured soil. Sandy clay, silty clay, and clay.

Firebreak. Area cleared of flammable material to stop or help control creeping or running fires. It also serves as a line from which to work and to facilitate the movement of men and equipment in fire fighting. Designated roads also serve as firebreaks.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flaggy soil material. Material that is, by volume, 15 to 35 percent flagstones. Very flaggy soil material is 35 to 60 percent flagstones, and extremely flaggy soil material is more than 60 percent flagstones.

Flagstone. A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist 6 to 15 inches (15 to 38 centimeters) long.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Fluvial. Of or pertaining to rivers; produced by river action, as a fluvial plain.

Foothill. A steeply sloping upland that has relief of as much as 1,000 feet (or 300 meters) and fringes a mountain range or high-plateau escarpment.

Foot slope. The inclined surface at the base of a hill.

Forb. Any herbaceous plant not a grass or a sedge.

Forest cover. All trees and other woody plants (underbrush) covering the ground in a forest.

Forest type. A stand of trees similar in composition and development because of given physical and biological factors by which it may be differentiated from other stands.

Fragile (in tables). A soil that is easily damaged by use or disturbance.

Fragipan. A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A fragipan appears cemented and restricts roots. When dry, it is hard or very hard and has a higher bulk density than the horizon or horizons above. When moist, it tends to rupture suddenly under pressure rather than to deform slowly.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Gabbro. A dark, coarse-grained basic igneous rock; the approximate intrusive equivalent of basalt.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Gilgai. Commonly a succession of microbasins and microknolls in nearly level areas or of microvalleys and microridges parallel with the slope. Typically, the microrelief of Vertisols—clayey soils having a high coefficient of expansion and contraction with changes in moisture content.

Glacial drift (geology). Pulverized and other rock material transported by glacial ice and then deposited. Also the sorted and unsorted material deposited by streams flowing from glaciers.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by glacial meltwater.

Glacial till (geology). Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Glaciofluvial deposits (geology). Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and occur as kames, eskers, deltas, and outwash plains.

Glaciolacustrine deposits. Material ranging from fine clay to sand derived from glaciers and deposited in glacial lakes mainly by glacial meltwater. Many deposits are interbedded or laminated.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

Graded stripcropping. Growing crops in strips that grade toward a protected waterway.

Granodiorite. A granitic rock intermediate in composition between granite and diorite.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock as much as 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, as much as 3 inches (7.6 centimeters) in diameter.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Hard rock. Rock that cannot be excavated except by blasting or by the use of special equipment that is not commonly used in construction.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material is sandy, loamy, or clayey and is cemented by iron oxide, silica, calcium carbonate, or other substance.

Head out. To form a flower head.

Hemic soil material (mucky peat). Organic soil material intermediate in degree of decomposition between the less decomposed fibric material and the more decomposed sapric material.

High-residue crops. Crops such as small grain and corn used for grain. If properly managed, residue from these crops can be used to control erosion until the next crop in the rotation is established. These crops return large amounts of organic matter to the soil.

Hill. A natural elevation of the land surface, rising as much as 1,000 feet above surrounding lowlands, commonly of limited summit area and having a well-defined outline; hillsides generally have slopes of more than 15 percent. The distinction between a hill and a mountain is arbitrary and is dependent on local usage.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an upper case letter represents the major horizons. Numbers or lower case letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the *Soil Survey Manual*. The major horizons of mineral soil are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying soil material. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, the number 2 precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but it can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group

A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Igneous rock. Rock formed by solidification from a molten or partially molten state. Major varieties include plutonic and volcanic rock. Examples are andesite, basalt, and granite.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Increasers. Species in the climax vegetation that increase in amount as the more desirable plants are reduced by close grazing. Increasers commonly are the shorter plants and the less palatable to livestock.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake in inches per hour is expressed as follows:

Less than 0.2	Very low
0.2 to 0.4	Low
0.4 to 0.75	Moderately low
0.75 to 1.25	Moderate
1.25 to 1.75	Moderately high
1.75 to 2.5	High
More than 2.5	Very high

Intermittent stream. A stream, or reach of a stream, that flows for prolonged periods only when it receives ground water discharge or long, continued contributions from melting snow or other surface and shallow subsurface sources.

Invaders. On range, plants that encroach into an area and grow after the climax vegetation has been reduced by grazing. Generally, plants invade following disturbance of the surface.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Kame (geology). An irregular, short ridge or hill of stratified glacial drift.

Karst (topography). The relief of an area underlain by limestone that dissolves in differing degrees, thus forming numerous depressions or small basins.

Knoll. A small, low, rounded hill rising above adjacent landforms.

Lacustrine deposit (geology). Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Landslide. The rapid downhill movement of a mass of soil and loose rock, generally when wet or saturated. The speed and distance of movement, as well as the amount of soil and rock material, vary greatly.

Large stones (in tables). Rock fragments 3 inches (7.5 centimeters) or more across. Large stones adversely affect the specified use of the soil.
Leaching. The removal of soluble material from soil or other material by percolating water.
Light textured soil. Sand and loamy sand.
Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.
Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.
Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.
Low-residue crops. Crops such as corn used for silage, peas, beans, and potatoes. Residue from these crops is not adequate to control erosion until the next crop in the rotation is established. These crops return little organic matter to the soil.
Low strength. The soil is not strong enough to support loads.
Marl. An earthy, unconsolidated deposit consisting chiefly of calcium carbonate mixed with clay in approximately equal amounts.
Mechanical treatment. Use of mechanical equipment for seeding, brush management, and other management practices.
Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.
Mesa. A broad, nearly flat topped and commonly isolated upland mass characterized by summit widths that are more than the heights of bounding erosional scarps.
Metamorphic rock. Rock of any origin altered in mineralogical composition, chemical composition, or structure by heat, pressure, and movement. Nearly all such rocks are crystalline.
Metavolcanic. Describing a variety of rocks of volcanic origin that have been subjected to metamorphic processes to an unspecified degree.
Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.
Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.
Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.
Moderately coarse textured soil. Coarse sandy loam, sandy loam, and fine sandy loam.
Moderately fine textured soil. Clay loam, sandy clay loam, and silty clay loam.
Moraine (geology). An accumulation of earth, stones, and other debris deposited by a glacier. Some types are terminal, lateral, medial, and ground.
Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.
Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).
Mountain. A natural elevation of the land surface, rising more than 1,000 feet above surrounding lowlands, commonly of restricted summit area (relative to a plateau) and generally having steep sides and considerable bare-rock surface. A mountain can occur as a single, isolated mass or in a group forming a chain or range.
Muck. Dark colored, finely divided, well decomposed organic soil material. (See Sapric soil material.)
Mudstone. Sedimentary rock formed by induration of silt and clay in approximately equal amounts.
Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR $6/4$ is a color in hue of 10YR, value of 6, and chroma of 4.
Narrow-base terrace. A terrace no more than 4 to 8 feet wide at the base. A narrow-base terrace is similar to a broad-base terrace, except for the width of the ridge and channel.
Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)
Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.
Observed rooting depth. Depth to which roots have been observed to penetrate.
Open space. A relatively undeveloped green or wooded area provided mainly within an urban area to minimize feelings of congested living.
Organic matter. Plant and animal residue in the soil in various stages of decomposition.
Outwash plain. A landform of mainly sandy or coarse textured material of glaciofluvial origin. An outwash

plain is commonly smooth; where pitted, it generally is low in relief.

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan.*

Parent material. The unconsolidated organic and mineral material in which soil forms.

Peat. Unconsolidated material, largely undecomposed organic matter, that has accumulated under excess moisture. (See Fibric soil material.)

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pediment. A gently sloping, erosional surface formed at the foot of a receding hill or mountain slope. May be essentially bare, exposing earth that extends beneath adjacent uplands, or may be thinly mantled alluvium in transit from upland front to basin or valley lowland.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil, adversely affecting the specified use.

Permafrost. Layers of soil, or even bedrock, occurring in arctic or subarctic regions, in which a temperature below freezing has existed continuously for a long time.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	Less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	More than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Pitting (in tables). Pits caused by melting around ice. They form on the soil after plant cover is removed.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Plateau. An extensive upland mass with relatively flat summit area that is considerably elevated (more than 100 meters) above adjacent lowlands and separated from them on one or more sides by escarpments.

Playa. The generally dry and nearly level lake plain that occupies the lowest parts of closed depressional areas, such as those on intermontane basin floors. Temporary flooding occurs primarily in response to precipitation and runoff.

Plinthite. The sesquioxide-rich, humus-poor, highly weathered mixture of clay with quartz and other diluents. It commonly appears as red mottles, usually in platy, polygonal, or reticulate patterns. Plinthite changes irreversibly to an ironstone hardpan or to irregular aggregates on repeated wetting and drying, especially if it is exposed also to heat from the sun. In a moist soil, plinthite can be cut with a spade. It is a form of laterite.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Ponding. Standing water on soils in closed depressions. The water can be removed only by percolation or evapotranspiration.

Poor filter (in tables). Because of rapid permeability or an impermeable layer near the surface, the soil may not adequately filter effluent from a waste disposal system.

Poor outlets (in tables). Refers to areas where surface or subsurface drainage outlets are difficult or expensive to install.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Post and piling outlet. A market location where posts and pilings are bought, processed, and sold.

Potential native plant community. The plant community on a given site that will be established if present environmental conditions continue to prevail and the site is properly managed. (See climax plant community.)

Potential rooting depth (effective rooting depth). Depth to which roots could penetrate if the content of moisture in the soil were adequate. The soil has no properties restricting the penetration of roots to this depth.

Prescribed burning. The application of fire to land under such conditions of weather, soil moisture, and time of day as presumably will result in the intensity of heat and spread required to accomplish specific forest management, wildlife, grazing, or fire hazard reduction purposes.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Proper grazing use. Grazing at an intensity that maintains enough cover to protect the soil and maintain or improve the quantity and quality of the desirable vegetation. This increases the vigor and reproduction of the key plants and promotes the accumulation of litter and mulch necessary to conserve soil and water.

Rangeland. Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Range condition. The present composition of the plant community on a range site in relation to the potential natural plant community for that site. Range condition is expressed as excellent, good, fair, or poor on the basis of how much the present plant community has departed from the potential.

Range site. An area of rangeland where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. A range site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other range sites in kind or proportion of species or total production.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—pH

Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Moderately acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Red beds. Sedimentary strata mainly red in color and composed largely of sandstone and shale.

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock.

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered, or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rill. A steep sided channel resulting from accelerated erosion. A rill generally is a few inches deep and not wide enough to be an obstacle to farm machinery.

Road cut. A sloping surface produced by mechanical means during road construction. It is commonly on the uphill side of the road.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Root zone. The part of the soil that can be penetrated by plant roots.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saline soil. A soil containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium.

Salty water (in tables.) Water that is too salty for consumption by livestock.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-size particles.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Saprolite (soil science). Unconsolidated residual material underlying the soil and grading to hard bedrock below.

Scarification. The act of abrading, scratching, loosening, crushing, or modifying the surface to increase water absorption or to provide a more tillable soil.

Schist. A metamorphic rock that has been largely or completely recrystallized and exhibits strong parallel or planar arrangement of platy or prismatic mineral grains; readily splits into thin plates or slabs.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Sequum. A sequence consisting of an illuvial horizon and the overlying eluvial horizon. (See Eluviation.)

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and runoff water.

Shrink-swell (in tables). The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silica. A combination of silicon and oxygen. The mineral form is called quartz.

Silica-sesquioxide ratio. The ratio of the number of molecules of silica to the number of molecules of alumina and iron oxide. The more highly weathered soils or their clay fractions in warm-temperate, humid regions, and especially those in the tropics, generally have a low ratio.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Sinkhole. A depression in the landscape where limestone has been dissolved.

Site class. A grouping of site indexes into 5 to 7 production capability levels. Each level can be represented by a site curve.

Site curve (50-year). A set of related curves on a graph that shows the average height of dominant trees for the range of ages on soils that differ in productivity. Each level is represented by a curve. The basis of the curves is the height of dominant trees that are 50 years old or are 50 years old at breast height.

Site curve (100-year). A set of related curves on a graph that show the average height of dominant and codominant trees for a range of ages on soils that differ in productivity. Each level is represented by a curve. The basis of the curves is the height of dominant and codominant trees that are 100 years old or are 100 years old at breast height.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slick spot. A small area of soil having a puddled, crusted, or smooth surface and an excess of exchangeable sodium. The soil generally is silty or clayey, is slippery when wet, and is low in productivity.

Slippage (in tables). Soil mass susceptible to movement downslope when loaded, excavated, or wet.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Sloughed till. Water-saturated till that has flowed slowly downhill from its original place of deposit by glacial ice. It may rest on other till, on glacial outwash, or on a glaciolacustrine deposit.

Slow intake (in tables). The slow movement of water into the soil.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.5 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Sodic (alkali) soil. A soil having so high a degree of alkalinity (pH 8.5 or higher), or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Sodicity. The degree to which a soil is affected by exchangeable sodium. Sodicity is expressed as a sodium absorption ratio (SAR) of a saturation extract, or the ratio of Na^+ to Ca^{++} + Mg^{++}. The degrees of sodicity are—SAR

Slight	Less than 13:1
Moderate	13-30:1
Strong	More than 30:1

Soft rock. Rock that can be excavated with trenching machines, backhoes, small rippers, and other equipment commonly used in construction.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows:Millimeters

Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	Less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stone line. A concentration of coarse fragments in a soil. Generally it is indicative of an old weathered surface. In a cross section, the line may be one fragment or more thick. It generally overlies material that weathered in place and is overlain by recent sediment of variable thickness.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter if rounded or 6 to 15 inches (15 to 38 centimeters) in length if flat.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stripcropping. Growing crops in a systematic arrangement of strips or bands that provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Tilling a soil below normal plow depth, ordinarily to shatter a hardpan or claypan.

Substratum. The part of the soil below the solum.

Subsurface layer. Technically, the E horizon. Generally refers to a leached horizon lighter in color and lower in content of organic matter than the overlying surface layer.

Summer fallow. The tillage of uncropped land during the summer to control weeds and allow storage of moisture in the soil for the growth of a later crop. A practice common in semiarid regions, where annual precipitation is not enough to produce a crop every year. Summer fallow is frequently practiced before planting winter grain.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Tail water. The water just downstream of a structure.

Talus. Rock fragments of any size or shape, commonly coarse and angular, derived from and lying at the base of a cliff or very steep, rock slope. The accumulated mass of such loose, broken rock formed chiefly by falling, rolling, or sliding.

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terminal moraine. A belt of thick glacial drift that generally marks the termination of important glacial advances.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet. A terrace in a field generally is built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay.* The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Till plain. An extensive flat to undulating area underlain by glacial till.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Too arid (in tables). The soil is dry most of the time, and vegetation is difficult to establish.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Toxicity (in tables). Excessive amount of toxic substances, such as sodium or sulfur, that severely hinder establishment of vegetation or severely restrict plant growth.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, are in soils in extremely small amounts. They are essential to plant growth.

Tuff. A compacted deposit that is 50 percent or more volcanic ash and dust.

Unstable fill (in tables). Risk of caving or sloughing on banks of fill material.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Valley fill. In glaciated regions, material deposited in stream valleys by glacial meltwater. In nonglaciated regions, alluvium deposited by heavily loaded streams.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but occurring in such a limited geographic area that creation of a new series is not justified.

Variegation. Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage.

Varve. A sedimentary layer or a lamina or sequence of laminae deposited in a body of still water within a year. Specifically, a thin pair of graded glaciolacustrine layers seasonally deposited, usually by meltwater streams, in a glacial lake or other body of still water in front of a glacier.

Water bars. Smooth, shallow ditches or depressional areas that are excavated at an angle across a sloping road. They are used to reduce the downward velocity of water and divert it off and away from the road surface. Water bars can easily be driven over if constructed properly.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Windthrow. The action of uprooting and tipping over trees by the wind.

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