This is a scanned version of the text of the original Soil Survey report of Benewah County Area, Idaho issued April 1980. Original tables and maps were deleted. There may be references in the text that refer to a table that is not in this document.

Updated tables were generated from the NRCS National Soil Information System (NASIS). The soil map data has been digitized and may include some updated information. These are available from http://soildatamart.nrcs.usda.gov.

Please contact the State Soil Scientist, Natural Resources Conservation Service (formerly Soil Conservation Service) for additional information.

Foreword

The Soil Survey of Benewah County Area, Idaho, contains much information useful in any land-planning program. Of prime importance are the predictions of soil behavior for selected land uses. Also highlighted are limitations or hazards to land uses that are inherent in the soil, improvements needed to overcome these limitations, and the impact that selected land uses will have on the environment.

This soil survey has been prepared for many different users. Farmers, ranchers, foresters, and agronomists can use it to determine the potential of the soil and the management practices required for food and fiber production. Planners, community officials, engineers, developers, builders, and homebuyers can use it to plan land use, select sites for construction, develop soil resources, or identify any special practices that may be needed to insure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the soil survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur even within short distances. Soils may be seasonally wet or subject to flooding. They may be shallow to bedrock. They may be too unstable to be used as a foundation for buildings or roads. Very clayey or wet soils are poorly suited to 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 kind of soil is shown on detailed soil maps. Each kind of soil in the survey area is described, and much information is given about each soil for specific uses. Additional information or assistance in using this publication can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

This soil survey can be useful in the conservation, development, and productive use of soil, water, and other resources.

Amos I. Garrison, Jr.
State Conservationist
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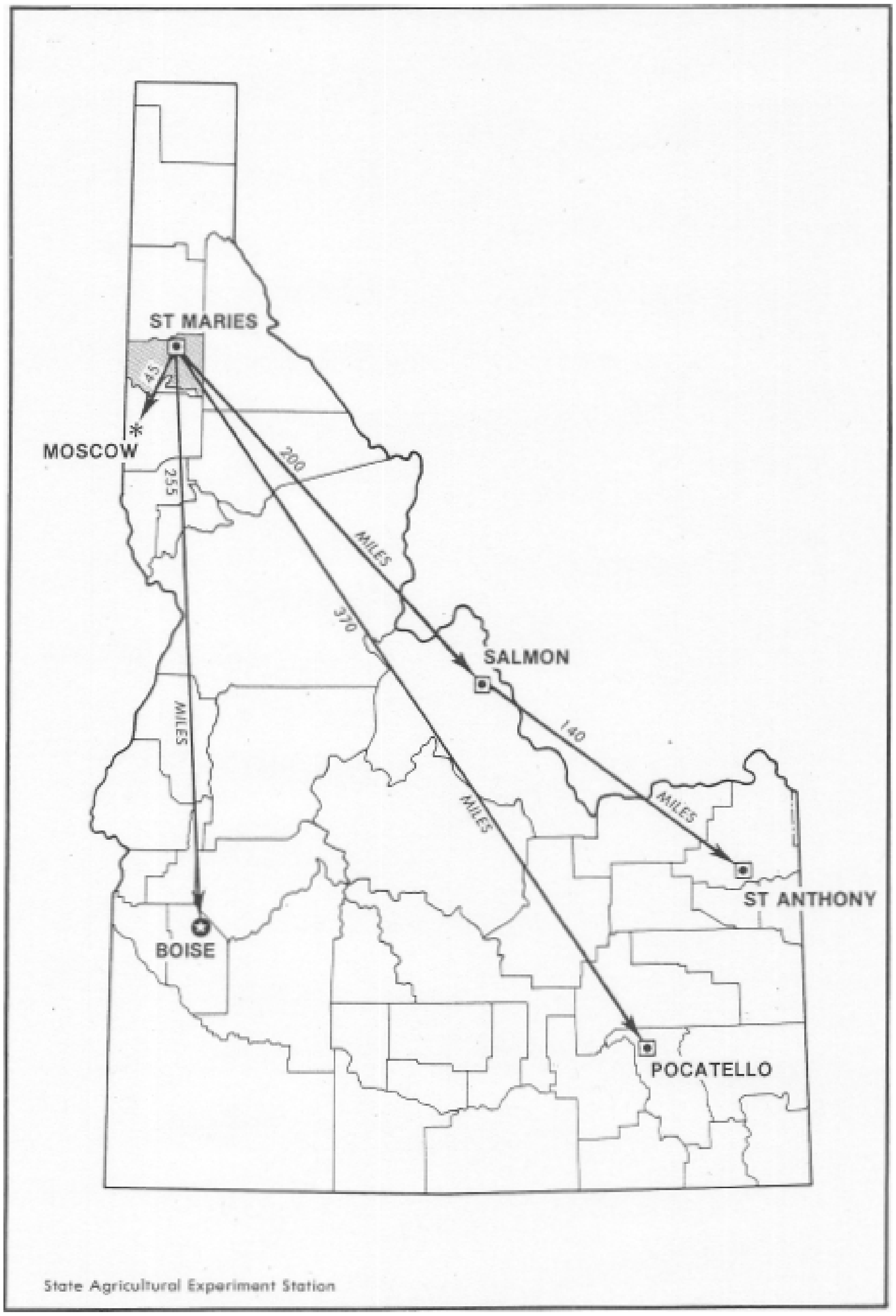

Location of Benewah County Area, Idaho

SOIL SURVEY OF BENEWAH COUNTY AREA, IDAHO

By Charles J. Weisel, Soil Conservation Service

Fieldwork by J. C. Chugg, A. E. Kreger, L. W. Garber, E. Moore, H. W. Biggerstaff, L. McConnell, S. R. Base, and R. J. Barker, Soil Conservation Service, and 0. R. Jones and R. Merritt, Bureau of Indian Affairs

The Benewah County Area is in the northern panhandle of Idaho (see locator map). It includes all of Benewah County except for the St. Joe National Forest in the southern part. It has a total area of 411,000 acres, or 642 square miles. St. Maries, the county seat, has a population of 2,650.

The land surface is generally rugged, consisting mainly of forested mountainous or hilly terrain, with comparatively narrow valleys that open to the west. In the western part of the survey area a rolling and hilly prairie region, called the Palouse, has been cleared and is farmed. The St. Joe and St. Maries Rivers flow across the eastern part of the survey area and join at the town of St. Maries. From here the St. Joe River flows west through a broad flood plain and into Chatcolet Lake in the northern part. Hangman Creek flows across the western part into the State of Washington. The lowest point in the Benewah County Area is Chatcolet Lake at 2,125 feet elevation. The highest elevations are in the northeastern part where some mountain peaks rise to more than 6,000 feet. The average elevation in the western prairie section is about 2,700 feet.

General nature of the survey area

This section gives general information concerning the county. It discusses history and development, natural resources, farming, recreation, and climate.

History and development

In Benewah County, Catholic missionaries settled in the St. Joe River Valley in 1846, and in the western part of the county, in Desmet, in 1877. The missionaries worked mainly with the Coeur d'Alene Indians on their reservation, which consisted of about half of the county until 1910. At this time the rich prairie lands were settled. Meanwhile major settlement activities took place in the forested area in the eastern part of the county.

Although there were some early settlers in the meadows along streams, the main influx of people did not begin until about 1900. It was then possible to acquire land as timber claims. Lumbering became the important industry, and settlement in relation to this industry increased.

Since the opening of the Coeur d'Alene Indian Reservation, settlement in this section has been comparatively rapid. Much of the land within the Indian Reservation is leased out. Some of it is farmed by Indians. Most of the people reside mainly in the towns and communities in the county. Some live on farms scattered throughout the forested sections.

The county was organized in 1915. St. Maries is now the largest city. Other cities and communities are Plummer, St. Joe City, Emida, Santa, Fernwood, Tensed, and Sanders. The population of these communities has fluctuated with the lumber industry.

Transportation facilities are supplied by railroads, highways, and water. The Chicago, Milwaukee, St. Paul, and Pacific Railroad serves the northern and eastern parts of the county. The Burlington Northern Railroad traverses the northwestern part. River boats navigate the St. Joe River as far as St. Joe City.

Graded roads, many of which were built mainly for logging, extend along the principal streams in the forested section. U.S. Highway 95A north extends south from St. Maries into Kootenai County and south through Emida to the southern part of the county. U.S. 95 runs north and south through Plummer. Few roads in the prairie section are paved.

St. Maries and Plummer have grade school and high school facilities. The outlying sections are well supplied with district schools. The Catholic Mission at Desmet provides educational facilities.

Lumbering continues to be a very important industry, and sawmills are at St. Maries, Fernwood, Plummer, Santa, and Tensed.

Natural resources

Soil and forests are the most important natural resources in the survey area. Livestock and crops that are produced on farms and timber from woodlands are marketable products derived from the soil.

Millions of board feet of ponderosa pine, western white pine, western redcedar, grand fir, hemlock, Douglas-fir, larch, spruce, and lodgepole pine are cut annually. Lumbering and the processing of wood products are the chief industries. In the Area is a large plywood mill, a wood chip plant, and several sawmills and specialty plants that produce cedar shakes, pickets, fenceposts, lath, and poles.

Benewah County has abundant water resources. The St. Joe River flows from Shoshone County west to St. Maries in Benewah County and is joined by the St. Maries River flowing northwest from Shoshone County. The St. Joe River then flows northwest from the city of St. Maries and feeds through Benewah, Round, and Chatcolet Lakes into Coeur d'Alene Lake.

Hangman Creek drainage in the southwestern part of Benewah County and Rock Creek in the northwestern corner are the main drainageways that flow northwest into Washington and the Spokane River. There are about 2,000 surface acres of water in the survey area excluding the lake complex of Benewah, Round, and Chatcolet Lakes.

Farming

About 81,300 acres of cropland are in Benewah County. The average annual precipitation of 20 to 26 inches is sufficient for annual cropping with moderate to high crop yields, depending upon individual soil conditions. Supplemental sprinkler irrigation for more intensive management and production has been used on only about 400 acres.

The Coeur d'Alene Indian Tribe and individual owners have about 51,800 acres, 24,500 acres of which are cultivated. The productive cropland soils in loess deposits are mostly owned by members of the Coeur d'Alene Tribe and are leased out for farming.

The Benewah Soil and Water Conservation District was organized on March 18, 1946. The District's original purpose was to promote the conservation of the soil resources of Benewah County. Recently the district program was expanded to include the conservation and development of all the resources.

Approximately 75 percent of the cropland lies in the watershed of 4 major creeks that drain the western third of the survey area. In this area most of the cropland is on cut-over timberlands, but much of it is on prairie soils. Winter wheat is the leading cash crop, accounting for more than half of the gross income from all crops produced in the county. Lentils, peas, barley, oats, grass seed, and hay are the other major crops. Liberal applications of commercial fertilizers and the use of improved varieties and management have substantially increased average yields. The remaining 25 percent of the cropland is bottom land and bench land adjacent to the major rivers and streams in the northern and eastern parts of the survey area. The bottom land is mainly used for the production of oats, hay, and pasture. The bench land is largely cut-over timberland. Most of it is planted to grasses and legumes for pasture and hay, but some areas are in small grain.

The survey area furnishes grazing for about 10,500 head of cattle annually. Grazing is on small meadows and creek bottom lands, timberlands, and cut-over timberlands.

Many small meadows in the heavily wooded eastern part of the survey area produce grass-legume hay. The western part provides some hay, but most of the land is used for grain or grass seed production.

Recreation

The survey area has very good opportunities for hunting and fishing. Elk, deer, bear, pheasant, grouse, rainbow and cutthroat trout, perch, and bass inhabit the area. Opportunities for boating and water sports are good on the St. Joe River and Chatcolet and Coeur d'Alene Lakes. Hiking, camping, canoeing, and sightseeing are other activities in the county.

The scenic quality of the St. Joe Valley is an asset to recreation in the area. The upper part of the river outside the area consists of crystal clear water, pools, falls, moss and fern covered cliffs, a large variety of trees, and views of timber-covered slopes. Down the valley, the scenery includes the tranquil, shadowy waters of the lower St. Joe River, tree lined levees, and pastoral scenes of lush, vegetated hillsides.

The ‘River that flows through the Lakes’ is a unique feature of the lower St. Joe. Here, the river flows 6 miles between two natural levees of land which are surrounded by the Benewah, Chatcolet, Round, Hidden, and Coeur d'Alene Lakes.

Climate

In the Benewah County Area, summers are warm or hot in most valleys but are much cooler in the mountains. Winters are cold in the mountains. Valleys are commonly colder than the lower slopes of adjacent mountains because of cold air drainage. In the mountains precipitation occurs throughout the year, and a deep snowpack accumulates during winter. In valleys precipitation in summer falls as showers; some thunderstorms occur. In winter the ground is covered with snow much of the time. Chinook winds are warm and dry and often melt and evaporate the snow.

Table 1 gives data on temperature and precipitation for the survey area, as recorded at St. Maries, Idaho, for the period 1951 to 1973. 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 is 31.2 degrees F, and the average daily minimum temperature is 24.1 degrees. The lowest temperature on record, which occurred at St. Maries on December 30, 1968, is -29 degrees.

In summer the average temperature is 65.0 degrees, and the average daily maximum temperature is 82.7 degrees. The highest recorded temperature, which occurred on August 4, 1961, is 109 degrees.

Growing degree days, shown in table 1, 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.

Of the total annual precipitation, 10 inches, or 33 percent, usually falls in April through September, which includes the growing season for most crops. In 2 years out of 10, the rainfall in April through September is less than 8 inches. The heaviest 1-day rainfall during the period of record was 2.12 inches at St. Maries on January 20, 1972. Thunderstorms occur on about 16 days each year, and most occur in summer.

Average seasonal snowfall is 59.5 inches. The greatest snow depth at any one time during the period of record was 35 inches. On the average, 28 days have at least 1 inch of snow on the ground, but the number of such days varies greatly from year to year.

The average relative humidity in midafternoon is less than 44 percent in spring and about 50 percent during the rest of the year. Humidity is higher at night, and the average at dawn is about 75 percent. The percentage of possible sunshine is 75 in summer and 42 in winter.

Climatic data in this section were specially prepared for the Soil Conservation Service by the National Climatic Center, Asheville, North Carolina.

How this survey was made

Soil scientists made this survey to learn what kinds of soil are in the survey area, where they are, and how they can be used. The soil scientists went into the area knowing they likely would locate many soils they already knew something about and perhaps identify some they had never seen before. They observed the steepness, length, and shape of slopes; the size of streams and the general pattern of drainage; the kinds of native plants or crops; the kinds of rock; and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material, which has been changed very little by leaching or by the action of plant roots.

The soil scientists recorded the characteristics of the profiles they studied, and they compared those profiles with others in counties nearby and in places more distant. Thus, through correlation, they classified and named the soils according to nationwide, uniform procedures.

After a guide for classifying and naming the soils was worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, roads, and other details that help in drawing boundaries accurately. The soil map at the back of this publication was prepared from aerial photographs.

The areas shown on a soil map are called soil map units. Some map units are made up of one kind of soil, others are made up of two or more kinds of soil, and a few have little or no soil material at all. Map units are discussed in the sections "General soil map for broad land use planning" and "Soil maps for detailed planning."

While a soil survey is in progress, samples of soils are taken as needed for laboratory measurements and for engineering tests. The soils are field tested, and interpretations of their behavior are modified as necessary during the course of the survey. New interpretations are added to meet local needs, mainly through field observations of different kinds of soil in different uses under different levels of management. Also, data are assembled from other sources, such as test results, records, field experience, and information available from state and local specialists. For example, data on crop yields under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soil.

But only part of a soil survey is done when the soils have been named, described, interpreted, and delineated on aerial photographs and when the laboratory data and other data have been assembled. The mass of detailed information then needs to be organized so that it is readily available to different groups of users, among them farmers, managers of rangeland and woodland, engineers, planners, developers and builders, homebuyers, and those seeking recreation.

General soil map for broad land use planning

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

The general soil map provides a broad perspective of the soils and landscapes in the survey area. It provides a basis for comparing the potential of large areas for general kinds of land use. Areas that are, for the most part, suited to certain kinds of farming or to other land uses can be identified on the map. Likewise, areas of soils having properties that are distinctly unfavorable for certain land uses can be located.

Because of its small scale, the map does not show the kind of soil at a specific site. Thus, it 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 kinds of soil in any one map unit differ from place to place in slope, depth, stoniness, drainage, or other characteristics that affect their management.

Each map unit is rated for cultivated farm crops, woodland, urban uses, and extensive recreation areas. Cultivated farm crops are those grown extensively by farmers in the survey area. Woodland refers to land that is producing either trees native to the area or introduced species. Urban uses include residential, commercial, and industrial developments. Extensive recreation areas include those used for nature study and as wilderness.

Undulating to steep, well drained and moderately well drained soils on loess-covered hills

Five map units are in this group. The soils in these map units make up about 30 percent of the Benewah County Area. These soils are mainly in the western part of the county, but some of these soils are in the eastern forested area. They formed in loess mixed with volcanic ash. They are very deep. Most of the acreage is used for cultivated crops. Elevations range from about 2,500 to 4,000 feet, and the average annual precipitation is about 10 to 35 inches. Average annual temperatures are about 42 to 50 degrees F, and the average frost-free season is about 100 to 150 days.

1. Southwick-Larkin

Very deep, undulating to hilly, slowly permeable and moderately slowly permeable, well drained and moderately well drained silt loam

This map unit is on the loess hills in the western part of the county. It makes up about 5 percent of the survey area. It is about 60 percent Southwick soils, 30 percent Larkin soils, and 10 percent soils of minor extent. The soils in this unit are warmer than the surrounding mountainous soils (fig. 1).

The Southwick soils are generally slightly lower on the landscape than the Larkin soils. They are moderately well drained. The Larkin soils are well drained. Both soils have a surface layer of silt loam and a silty clay loam subsoil. Southwick soils are slowly permeable and have a perched water table during spring. Larkin soils are moderately slowly permeable.

Soils of minor extent in this map unit are the moderately well drained Taney soils and the somewhat poorly drained Latahco soils.

This map unit is used for dryfarmed crops and for woodland- Small grain, peas, lentils, hay, pasture, and grass seed are the main crops. Slopes, surface runoff, and high erodibility of the soils are major limitations to farming. Runoff and subsequent accumulation of water in drainageways commonly is great enough to cause gullying and damage to existing structures.

Permeability, potential frost action, and the perched water table of the Southwick soil cause difficulty in maintenance of roads. The shrink-swell potential in the silty clay loam subsoil of these soils can cause concerns with dwellings. The perched water table of the Southwick soil can also be a concern. Septic tank filter fields commonly do not function properly. The soils in this map unit have potential for openland and woodland wildlife habitats.

2. Taney

Very deep, undulating to hilly, slowly permeable, moderately well drained silt loam

This map unit is on loess-covered hills in the western half of the county. It makes up about 5 percent of the survey area. It is about 80 percent Taney soils and 20 percent soils of minor extent.

The Taney soils have a silt loam surface layer and a silty clay loam subsoil. They have a perched water table during spring.

Soils of minor extent in this map unit are the moderately well drained Southwick and Santa soils, the well drained Larkin soils, and the somewhat poorly drained Moctileme soils.

This map unit is used mainly for dryfarmed crops and for woodland. Small grain, peas, lentils, hay, pasture, and grass seed are the main crops (fig. 2). Taney soils are erodible, and crop production is reduced in areas where accelerated erosion has occurred.

Very slow permeability, a perched water table, and potential frost action are limitations to homesites, dwellings, septic tank filter fields, sanitary facilities, and roads. Drainageways commonly accumulate enough water during high runoff periods to cause gullying and damage to stream structures. The soils in this map unit have potential for woodland and for openland wildlife habitat.

3. Santa

Very deep, undulating to steep, slowly permeable, moderately well drained silt loam that has very dense, brittle layers

This map unit is throughout the county on loess-covered hills. It makes up about 6 percent of the survey area. It is 70 percent Santa soils and 30 percent soils of minor extent.

The Santa soils have a silty loam surface layer and a very dense, silty clay loam subsoil. They have a perched water table during spring.

Soils of minor extent in this map unit are the moderately well drained Taney and Helmer soils, the somewhat poorly drained Moctileme soils, and the very poorly drained Porrett soils.

This map unit is used mainly for woodland, and small areas are cultivated for small grain, pasture, hay, and grass seed (fig. 3). The major limitations to farming are the very dense subsoil, which restricts root growth, and the erodibility of the soils.

The perched water table during spring and susceptibility to frost action are limitations to dwellings and roads. Septic tank filter fields will not function properly. The soils in this unit have potential for woodland and for openland wildlife habitat.

4. Helmer

Very deep, undulating to steep, slowly permeable, moderately well drained silt loam that has dense, brittle layers

Most areas of this map unit are in the eastern, more forested parts of the county. This unit makes up about 12 percent of the survey area. It is about 70 percent Helmer soils and 30 percent soils of minor extent.

The Helmer soils have a silt loam surface layer and a dense, silt loam, buried subsoil. They have a perched water table during spring.

Soils of minor extent in this map unit are the well drained Huckleberry soils, the moderately well drained Santa soils, and the very poorly drained Pokey, Potlatch and Porrett soils.

This map unit is used mainly for woodland, recreation, wildlife habitat, and watershed, and small areas are used for pasture. The erodibility of the soils and the perched water table in spring are limitations to logging and farming operations. The dense subsoil also restricts root growth.

The perched water table and susceptibility to frost action are limitations to dwellings and roads. Septic tank filter fields will not function properly. The soils in this unit have potential for woodland or for openland wildlife habitat.

5. Palouse-Thatuna

Very deep, undulating to steep, moderately permeable and slowly permeable, well drained and moderately well drained silt loam

This map unit is mainly in the southwestern part of the county. It makes up about 2 percent of the survey area. It is about 55 percent Palouse soils, 25 percent Thatuna soils, and 20 percent soils of minor extent.

The Palouse soils generally have a more southerly exposure, and the Thatuna soils generally have a northerly exposure. Palouse soils are well drained and moderately permeable and have a silt loam surface layer and subsoil. Thatuna soils are moderately well drained and slowly permeable and have a silt loam surface layer and a silty clay loam subsoil. Thatuna soils have a perched water table during spring.

Soils of minor extent in this map unit are the well drained Garfield, Naff, and Schumacher soils; the moderately well drained Tilma soils; and the somewhat poorly drained Cald soils.

This map unit is used mainly for dryfarmed crops. The major crops are peas, lentils, small grain, hay, pasture, and grass seed. The hazard of erosion is the main limitation to farming. Thatuna soils also have a wetness limitation because of the perched water table in spring.

The limited ability of this map unit to support a load and the high potential frost action are limitations to urban and residential uses. Thatuna soils also have a shrink-swell potential -upon drying and wetting. These limitations cause difficulty in road maintenance. Septic tank filter fields function properly in the Palouse soils, but not in the Thatuna soils. The soils in this map unit have potential for openland and rangeland wildlife habitats.

Steep and very steep, well drained soils on mountains

Five map units are in this group. The soils in these map units make up about 54 percent of the Benewah County Area. These soils are throughout the county. These soils formed in a loess mantle that contains volcanic ash over material derived from metasedimentary or granitic bedrock or shale. They are shallow to deep. Most of the acreage is forested. Elevations range from about 2,300 to 6,200 feet, and the average annual precipitation is about 25 to 50 inches. Average annual temperatures are about 38 to 47 degrees F, and the average frost-free season is about 45 to 120 clays.

6. Ardenvoir-McCrosket-Tekoa

Moderately deep and deep, steep and very steep, moderately permeable gravelly loam and gravelly or shaly silt loam

This map unit is throughout the county, generally in the mountainous areas. It makes up about 10 percent of the survey area. It is about 40 percent Ardenvoir soils, 30 percent McCrosket soils, 15 percent Tekoa soils, and 15 percent soils of minor extent. The soils in this unit formed in a loess and volcanic ash mantle over material derived from metasedimentary rock.

The Ardenvoir soils are on the colder and moister north aspects, and the McCrosket and Tekoa soils are on the drier and warmer south aspects. Ardenvoir and McCrosket soils have a gravelly loam or gravelly silt loam surface layer and a gravelly or very gravelly subsoil, and bedrock is at a depth of 40 to 60 inches. Tekoa soils have a gravelly silt loam surface layer and a shaly silt loam or very shaly loam subsoil, and bedrock is at a depth of 20 to 40 inches. Soils of minor extent in this map unit are the Huckleberry soils.

This map unit is not farmed because of steep slopes. It is mainly used for woodland, grazing, wildlife habitat, and recreation. Slopes, high percentage of coarse fragments, and the hazard of erosion restrict timber production and logging operations.

The soils in this map unit have poor potential for roads and dwellings because of the slopes and depth to bedrock. They have poor potential for farming because of slopes and the hazard of erosion. They have good potential for woodland and for wildlife habitat.

7. Huckleberry-Ardenvoir

Moderately deep and deep, steep andvery steep, moderately permeable silt loam and gravelly loam

This map unit is throughout the county on mountain side slopes. It makes up about 38 percent of the survey area. It is about 65 percent Huckleberry soils, 30 percent Ardenvoir soils, and 5 percent soils of minor extent. The soils in this unit formed in a loess and volcanic ash mantle over material derived from metasedimentary rock.

The Huckleberry soils are on the colder, north aspects where moisture is more effective. They have a silt loam or gravelly silt loam subsoil, and bedrock is at a depth of 20 to 40 inches. Ardenvoir soils are on the warmer, south aspects where moisture is less effective. They have a gravelly loam surface layer and subsoil, and bedrock is at a depth of 40 to 60 inches.

Soils of minor extent in this map unit are the well drained, drier, and warmer McCrosket soils and the moderately well drained, very deep Santa soils.

This map unit is used mainly for woodland. The hazard of erosion, slopes, and the high percentage of coarse fragments in the soils restrict timber production and harvesting.

The soils in this map unit have poor potential for roads and dwellings because of the slopes, depth to bedrock, and inaccessibility. They have poor potential for farming because of slopes and the hazard of erosion. They have good potential for woodland wildlife habitat.

8. Divers-Brickel

Moderately deep and deep, very steep, moderately permeable silt loam and cobbly loam

This map unit is generally at the higher mountain elevations in the eastern part of the county. It makes up about 4 percent of the survey area. It is about 55 percent Divers soils, 35 percent Brickel soils, and 10 percent Rubble land. The soils in this unit formed in a mantle of loess and volcanic ash over material derived from metasedimentary rock.

The Divers soils have a silt loam surface layer and a silt loam and gravelly silt loam subsoil, and bedrock is at a depth of more than 40 inches. The Brickel soils have a cobbly loam surface layer and a very cobbly loam subsoil, and bedrock is at a depth of 20 to 40 inches. Divers soils have more influence from volcanic ash than Brickel soils. Brickel soils are generally at a higher elevation than Divers soils. Rubble land is made up of loose stones and boulders.

This map unit is used for woodland, wildlife habitat, limited grazing, recreation, and watershed. The cold climate, high elevation, slope, and amount of rock fragments are limitations to these uses.

The soils in this map unit have poor potential for dwellings and roads because of slope and inaccessibility. They have good potential for woodland wildlife habitat.

9. Jacot-Garveson

Very deep, very steep, moderately permeable and moderately rapidly permeable loam and coarse sandy loam

This map unit is mainly on mountain side slopes in the northeastern part of the county. It makes up about 1 percent of the survey area. It is about 40 percent Jacot soils, 40 percent Garveson soils, and 20 percent soils of minor extent. The soils in this map unit formed in a loess and volcanic ash mantle over materials derived from granitic rock.

The Jacot soils have a coarse sandy loam surface layer and subsoil. The Garveson soils have a loam surface layer and a loam and gravelly silt loam subsoil.

Soils of minor extent in this map unit are the very poorly drained Pokey and Potlatch soils and the moderately well drained Helmer soils.

This map unit is used mainly for woodland. Cut-over areas are used for grazing. Slope and the hazard of erosion are limitations to timber production and harvesting and to grazing.

The soils in this unit have poor potential for dwellings and roads because of inaccessibility and slope. They have good potential for woodland wildlife habitat.

10. Nakarna

Very deep, steep and very steep, moderately permeable silt loam

This map unit is mainly on mountain side slopes in the southeastern part of the county. It makes up about 1 percent of the survey area. It is about 60 percent Nakarna soils on very steep slopes, 20 percent Nakarna soils on steep slopes, and 20 percent soils of minor extent.

The Nakarna soils have a silt loam and fine sandy loam subsoil. They formed in a loess and volcanic ash mantle over materials derived from schist.

Soils of minor extent in this map unit are the moderately well drained Helmer soils, the very poorly drained Pokey soils, and the poorly drained Potlatch soils.

This map unit is used mainly for woodland. Slope and the hazard of erosion are limitations to timber production and harvesting.

The soils of this unit have poor potential for dwellings and roads because of inaccessibility and steep slopes. They have good potential for woodland wildlife habitat.

Sloping to very steep, well drained soils on basalt terraces and escarpments

One map unit is in this group. The soils in this map unit make up about 10 percent of the Benewah County Area. They are throughout the county. These soils formed in loess and volcanic ash that overlies basaltic lava flows. They are shallow and moderately deep. Most of the acreage is forested. Elevations range from 2,200 to 3,200 feet. The average annual precipitation is about 22 to 30 inches. Average annual temperatures are about 40 to 48 degrees F, and the average frost-free season is 60 to 140 days.

11. Blinn-Dorb-Bobbitt

Moderately deep, moderately permeable silt loam and stony loam.

This map unit is throughout the county wherever basalt flows are located. It makes up about 10 percent of the survey area. It is about 30 percent Blinn soils, 25 percent Dorb soils, 20 percent Bobbitt soils, and 25 percent soils of minor extent and Rock outcrop. The soils in this map unit formed in a loess and volcanic ash mantle over material derived from basalt. They have basalt at a depth of 20 to 40 inches.

The Blinn soils have a stony loam surface layer and subsoil. The Dorb soils are cold, have a high content of volcanic ash, and have a silt loam and very cobbly silt loam subsoil. The Bobbitt soils are on south aspects and are the warmest. They have a stony loam surface layer and a very stony clay loam subsoil.

Soils of minor extent in this map unit are the well drained Lacy soil, the moderately well drained Santa and Chatcolet soils, and Rock outcrop.

This map unit is used mainly for woodland, recreation, wildlife habitat, and watershed; and some cleared areas are used for limited grazing. The slope, large amount of rock fragments on the surface and in the soils, and moderate depth to bedrock are limitations to farming. The soils in this unit are mostly on steep escarpments or near Rock outcrop which is a limitation to timber production and harvesting.

The soils in this map unit have poor potential for urban dwellings and road development because of the slopes, stones, and the depth to bedrock. Much of the basalt is relatively hard and causes difficulty in installation of sanitary facilities. Potential is good for woodland wildlife habitat.

Undulating to hilly, moderately well drained soils on lake terraces

One map unit is in this group. The soils in this map unit make up about 1 percent of the Benewah County Area. They are in small areas on lake terraces throughout the area. These soils formed in a volcanic ash mantle over glacio-lacustrine sediment. They are very deep. Most of the acreage is used for urban developments, pasture, or woodland. Elevations range from 2,300 to 2,800 feet. The average annual precipitation is about 25 to 30 inches, and the average annual temperatures are about 38 to 42 degrees F. The average frost-free season is about 70 to 90 days.

12. Chatcolet

Very deep, moderately slowly permeable silt loam

This map unit is throughout the county on old lake terraces. It makes up about 1 percent of the survey area. It is about 85 percent Chatcolet soils and 15 percent soils of minor extent. These soils formed in a volcanic ash mantle over lake-laid sediment.

The Chatcolet soils have a silt loam surface layer and a silt loam silty clay loam subsoil. Soils of minor extent in this map unit are the well drained Dorb soils.

This map unit is used for urban and recreational homesites. Small areas are used for pasture and woodland. The cool climate is a limitation to farming.

The soils in this map unit have good potential for dwellings and roads, but slope and the low strength of the soils are concerns in designing structures. The soils are also susceptible to frost action which causes difficulty in maintenance of roads. The moderately slow permeability is a concern to the use of septic tank absorption fields. The potential is good for woodland wildlife habitat.

Level and nearly level, very poorly drained to somewhat poorly drained soils on flood plains and low stream terraces

Three map units are in this group. The soils in these map units make up 5 percent of the Benewah County Area. They are on flood plains and low stream terraces throughout the county. These soils are very deep. They formed in alluvium and organic materials. Nearly all of the acreage is used for cultivated crops, hay, and pasture. Elevations range from 2,125 to 3,500 feet, and the average annual precipitation is 20 to 30 inches. Average annual temperatures are 39 to 47 degrees F, and the average frost-free season is 60 to 100 days.

13. Miesen-DeVoignes-Pywell

Very deep, somewhat poorly drained and very poorly drained, moderately permeable and slowly permeable, stratified mineral and organic soils

This map unit is mainly along the St. Joe River flood plain. It makes up about 1 percent of the survey area. It is about 40 percent Miesen soils, 25 percent DeVoignes soils, 20 percent Pywell soils, and 15 percent soils of minor extent.

The Miesen soils are somewhat poorly drained, and the DeVoignes and Pywell soils are very poorly drained. Miesen are mineral soils made up of stratified silt loam and fine sandy loam. DeVoignes soils are stratified with layers of organic and mineral materials made up of silt loam and silty clay loam. Pywell soils are stratified organic material. The soils in this map unit have a high water table and are subject to flooding. Soils of minor extent are the very poorly drained Ramsdell soils.

This map unit is used for nonirrigated small grain, pasture, hay, and grass seed. The high water table and frequent flooding are the main limitations to farming. The cool climate also limits the choice of crops. Some drainage can be provided for the more poorly drained soil to allow seeding of more desirable grasses and small grain.

The soils in this map unit have poor potential for dwellings and roads because of the high water table and flooding. Potential is good for wetland wildlife habitat and is fair for openland and rangeland wildlife.

14. Latahco-Moctileme-Cald

Very deep, moderately slowly permeable, somewhat poorly drained silt loam

This map unit is in the western part of the county along streams and drainageways adjacent to loess hills. It makes up about 3 percent of the survey area. It is about 45 percent Latahco soils, 25 percent Moctileme soils, 25 percent Cald soils, and 5 percent soils of minor extent. These soils formed in alluvium derived from loess and volcanic ash.

Latahco and Moctileme soils have a silt loam surface layer and a silty clay loam subsoil. The Cald soils are silt loam throughout. Latahco soils are generally slightly higher in elevation than Moctileme and Cald soils. Cald soils are warmer than Latahco and Moctileme soils. All of the soils in this map unit are subject to flooding. They have a seasonal high water table.

Soils of minor extent in this map unit are the moderately well drained Thatuna soils and the somewhat poorly drained Lovell soils.

This map unit is used mainly for nonirrigated small grain, peas, and lentils and for hay, pasture, and grass seed. Some areas are in native woodland. Wetness and flooding are limitations to farming. The water table is highest during spring. Use of equipment is generally limited until after runoff.

The soils in this map unit have good potential for cultivated crops if the areas are adequately drained and protected from flooding. They have poor potential for dwellings and roads because of wetness and flooding. They have good potential for wetland and openland wildlife habitats. The Cald soils have good potential for openland wildlife habitat, and the Latahco and Moctileme soils have good potential for woodland wildlife habitat.

15. Pokey-Potlatch

Very deep, moderately rapidly permeable and very slowly permeable, very poorly drained and poorly drained fine sandy loam and silt loam

This map unit is in the southeastern part of the county. It makes up about 1 percent of the county. It is about 50 percent Pokey soils, 40 percent Potlatch soils, and 10 percent soils of minor extent.

The very poorly drained Pokey soils are on low stream terraces and flood plains. They have a fine sandy loam surface layer over coarse sand and gravel. The poorly drained Potlatch soils are on alluvial fans and terraces. They have a silt loam surface layer and a silty clay loam subsoil. Both soils have a seasonal high table and are subject to frequent flooding. Soils of minor extent in this map unit are highly stratified and are made up of varying layers of silt loam, sandy loam, sand gravel, and cobbles. Strip mines are also present in areas.

This map unit is used mainly for hay, pasture, and wildlife habitat. Wetness and flooding are limitations to farming. Drainage and protection from flooding are difficult.

The soils in this map unit have poor potential for dwellings and roads because of flooding and wetness. They have good potential for woodland and for some openland and wetland wildlife habitats.

Soil maps for detailed planning

The map units shown on the detailed soil maps at the back of this publication represent the kinds of soil in the survey area. They are described in this section. The descriptions together with the soil maps can be useful in determining the potential of a soil and in managing it for food and fiber production; in planning land use and developing soil resources; and in enhancing, protecting, and preserving the environment. More information for each map unit, or soil, is given in the section "Use and management of the soils."

Preceding the name of each map unit is the symbol that identifies the soil on the detailed soil maps. Each soil description includes general facts about the soil and a brief description of the soil profile. In each description, the principal hazards and limitations are indicated, and the management concerns and practices needed are discussed.

The map units on the detailed soil maps represent an area on the landscape made up mostly of the soil or soils for which the unit is named. Most of the delineations shown on the detailed soil map are phases of soil series.

Soils that have a profile that is almost alike make up a *soil series.* Except for allowable differences in texture of the surface layer or of the underlying substratum, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement in the profile. A soil series commonly is named for a town or geographic feature near the place where a soil of that series was first observed and mapped.

Soils of one series can differ in texture of the surface layer or in the underlying substratum and in slope, erosion, stoniness, salinity, wetness, or other characteristics that affect their use. On the basis of such differences, a soil series is divided into phases. The name of a *soil phase* commonly indicates a feature that affects use or management. For example, Larkin silt loam, 3 to 12 percent slopes, is one of several phases within the Larkin series.

Some map units are made up of two or more dominant kinds of soil. Such map units are called soil complexes and soil associations.

A *soil complex* consists of areas of two or more soils that are so intricately mixed or so small in size that they cannot be shown separately on the soil map. Each area includes some of each of the two or more dominant soils, and the pattern and proportion are somewhat similar in all areas. Garfield-Tilma complex, 3 to 40 percent slopes, is an example.

A *soil association* is made up of soils that are geographically associated and are shown as one unit on the map because it is not practical to separate them. A soil association has considerable regularity in geographic pattern and in the kinds of soil that are a part of it. The extent of the soils can differ appreciably from one delineation to another; nevertheless, interpretations can be made for use and management of the soils. McCrosket-Tekoa association, very steep, is an example.

Most map units include small, scattered areas of soils other than those that appear in the name of the map unit. Some of these soils have properties that differ substantially from those of the dominant soil or soils and thus could significantly affect use and management of the map unit. These soils are described in the description of each map unit. Some of the more unusual or strongly contrasting soils that are included are identified by a special symbol on the soil map.

Most mapped areas include places that have little or no soil material and support little or no vegetation. Such places are called *miscellaneous areas;* they are delineated on the soil map and given descriptive names. Rock outcrop is an example. Some of these areas are too small to be delineated and are identified by a special symbol on the soil map.

This survey was mapped at two levels of detail and have narrowly defined and broadly defined map units. The broadly defined units are identified by an asterisk following the map unit name in the soil legend. In the narrowly defined units the soil delineation boundaries were plotted and verified at closely spaced intervals. In the broadly defined units the soil delineation boundaries were plotted and verified by some observations. The detail of mapping selected was based on the anticipated long term use of the survey, and the map units were designed to meet the needs for that use..

The acreage and proportionate extent of each map unit are given in table 4, and additional information on properties, limitations, capabilities, and potentials for many soil uses is given for each kind of soil in other tables in this survey. (See "Summary of tables.") Many of the terms used in describing soils are defined in the Glossary.

1-Aquic Xerofluvents, nearly level. Aquic Xerofluvents are poorly drained, erratically stratified soils that have a variable surface texture. These soils are on stream bottoms and low stream terraces in mountainous areas at elevations of 2,200 to 2,800 feet. They formed in alluvium derived from mixed sources recently deposited by rivers and streams. The average annual precipitation is about 30 inches, and the average annual air temperature is about 43 degrees F.

Included with these soils in mapping are small areas of Ramsdell silt loam and Porrett silt loam that have slopes of 0 to 2 percent.

These soils have moderate to very rapid permeability. The effective rooting depth is 60 inches or more. Surface runoff is slow, and erosion by channelization is likely during periods of flooding. These soils have a seasonal high water table at a depth of 18 to 24 inches from February through May. They are frequently flooded for brief periods during spring.

Aquic Xerofluvents are used for pasture, woodland, or wildlife habitat.

These soils have variable suitability for woodland use. Areas of soils that have a fairly thick surface layer of silt loam or loam are suited to the production of western redcedar, grand fir, western white pine, Douglas-fir, western larch, and lodgepole pine. Areas of soils that have a very cobbly sand surface layer are poorly suited. The seasonal high water table and flooding during spring restrict timber production. Trees can be harvested by using conventional methods although these methods can be restricted during the wet season.

Forested areas provide woodland habitat for white-tailed deer, black bear, elk, squirrels, chipmunks, and various songbirds. The soils also have potential for wetland wildlife habitat.

Homesite development and recreational facilities are restricted on this soil because of flooding and the seasonal high water table. Capability subclass Vllw.

2-Ardenvoir-Huckleberry association, steep. This map unit consists of steep soils on mountain side slopes at elevations between 2,800 and 4,000 feet. It is about 55 percent Ardenvoir gravelly loam, 20 to 35 percent slopes, and 35 percent Huckleberry silt loam, 20 to 35 percent slopes. The Ardenvoir soil has southerly exposures, is on ridgetops, and dries out fast. It supports a grand fir-pachistima plant community (3). The Huckleberry soil has northerly exposures, is in swales and is moist longer. It supports a cedar-pachistima plant community.

Included with these soils in mapping are areas of Santa silt loam, 20 to 35 percent slopes, and small areas of Helmer silt loam. These included soils make up about 10 percent of the map unit.

The Ardenvoir soil is deep and well drained over weathered metasedimentary bedrock. It formed in loess containing volcanic ash material that weathered from the metasediment rock. Permeability is moderate. Effective rooting depth is 40 to 60 inches. Available water capacity is 4 to 60 inches. Surface runoff is rapid, and the hazard of erosion is high. The average annual precipitation is about 29 inches, including 5 to 10 feet of snow, and average annual air temperature is about 42 degrees F.

In a typical profile of the Ardenvoir soil the surface layer is brown and light yellowish brown, neutral and slightly acid gravelly loam about 9 inches thick. The subsoil is very pale brown, slightly acid gravelly loam about 8 inches thick. The substratum is very pale brown, medium acid very cobbly loam and very flaggy loam about 29 inches thick. Weathered metasedimentary bedrock is at a depth of 46 inches.

The Huckleberry soil is moderately deep and well drained. It formed in a surface mantle of volcanic ash and loess and the residuum from weathered shale. Permeability is moderate. Effective rooting depth is 20 to 40 inches. Available water capacity is 5 to 6 inches. Surface runoff is rapid, and the hazard of erosion is high. The average annual precipitation is about 35 inches, and average annual air temperature is about 41 degrees F.

In a typical profile of the Huckleberry soil the surface is covered by about 3 inches of coniferous needles and twigs. The upper part of the subsoil is yellowish brown and light yellowish brown, medium acid silt loam about 16 inches thick. The lower part of the subsoil is pale brown, medium acid gravelly silt loam about 10 inches thick. The substratum is very pale brown, medium acid very gravelly loam about 10 inches thick. Shale is at a depth of about 36 inches.

The Ardenvoir soil is suited to the production of grand fir, Douglas-fir, and western larch. It is capable of producing about 5,900 cubic feet per acre 0.6 inch and more in diameter or 18,500 board feet (Scribner rule) of merchantable timber 11.6 inches and more in diameter from an unmanaged stand of 80 year old trees. Steep slopes and the high hazard of erosion restrict the use of the Ardenvoir soil for timber production. Trees can be harvested by conventional methods, but landings, logging roads, and skid trails require careful planning to minimize soil losses. Carefully managed reforestation after harvest reduces plant competition of undesirable understory plants.

The Ardenvoir soil has potential for grazing where the tree canopy is opened by logging, fire, or some other disturbance. Seeding disturbed areas of this soil to adapted grasses increases forage production and helps protect the soil. Important forage plants are elk sedge, mountain maple, and red-stem ceanothus. Creambrush oceanspray and mallow ninebark, two relatively unpalatable shrubs, tend to dominate the vegetation once the tree canopy is opened. Management of vegetation should be designed to protect timber regeneration and to insure adequate litter for soil protection.

The Ardenvoir soil produces forage for livestock and big game animals for 20 to 30 years following opening of the canopy. During this period, total annual production varies from about 1,800 pounds of air-dry forage per acre to less than 200 pounds per acre as the canopy closes.

The Huckleberry soil is suited to the production of western red cedar, western white pine, Douglas-fir, grand fir, western larch, and lodgepole pine. It is capable of producing about 10,350 cubic feet per acre 0.6 inch and more in diameter or 34,600 board feet (Scribner rule) of merchantable timber 12.6 inches and more in diameter from an unmanaged stand of 80 year old trees. Steep slopes and the high hazard of erosion restrict the use of the Huckleberry soil for timber production. Trees can be harvested by conventional methods, but landings, logging roads, and skid trails require careful planning to minimize soil losses.

The Huckleberry soil has potential for grazing where the tree canopy is opened by logging or fire. Seeding disturbed areas of this soil to adapted grasses increases forage production. Important forage plants are elk sedge, willow, mountain maple, and red-stem ceanothus. Management of vegetation should be designed to protect timber regeneration and to insure adequate litter for soil protection.

The Huckleberry soil produces forage for livestock and big game animals for 10 to 15 years following opening of the canopy. During this period, the total annual production varies from about 2,200 pounds of air-dry forage per acre to less than 150 pounds per acre as the canopy closes.

Areas of this map unit provide woodland wildlife habitat for white-tailed deer, elk, black bear, chipmunks, squirrels, and forest grouse.

Steep slopes and depth to bedrock are limitations for the construction of homes, cabins, and roads. The extent of site preparation needed is a major limitation to dwellings. Slopes and dust are the main limitations for such recreational developments as trails and camp areas. Both soils in capability subclass VIe.

3-Ardenvoir-Huckleberry association, very steep. This map unit consists of very steep soils on mountain side slopes at elevations between about 2,800 to 4,000 feet. It is about 55 percent Ardenvoir gravelly loam, 35 to 65 percent slopes, and 35 percent Huckleberry silt loam, 35 to 65 percent slopes. The Ardenvoir soil has southerly exposures, is in ridgetops, and dries out fast. It supports a grand fir-pachistima plant community. The Huckleberry soil has northerly exposures, is in swales, and is moist longer. It supports a cedar-pachistima plant community.

Included with these soils in mapping are areas of McCrosket very gravelly loam, 35 to 65 percent slopes, and small areas of Rock outcrop. These included soils make up about 10 percent of the map unit.

The Ardenvoir soil is deep and well drained over weathered metasedimentary bedrock. It formed in material weathered from metasediment rock and loess containing volcanic ash. Permeability is moderate. Effective rooting depth is 40 to 60 inches. Available water capacity is 40 to 60 inches. Surface runoff is very rapid, and the hazard of erosion is very high. The average annual precipitation is about 29 inches, including 5 to 10 feet of snow, and average annual air temperature is about 42 degrees F.

In a typical profile of the Ardenvoir soil the surface layer is brown and light yellowish brown, neutral and slightly acid gravelly loam 9 inches thick. The subsoil is very pale brown, slightly acid gravelly loam about 8 inches thick. The substratum is very pale brown, medium acid very cobbly loam and very flaggy loam about 29 inches thick. Weathered metasedimentary bedrock is at a depth of 46 inches.

The Huckleberry soil is moderately deep and well drained. It formed in a surface mantle of volcanic ash and loess and in the underlying material weathered from metasedimentary rock. Permeability is moderate. Effective root depth is 20 to 40 inches. Available water capacity is 5 to 6 inches. Surface runoff is very rapid, and the hazard of erosion is very high. The average annual precipitation is about 35 inches, and average annual air temperature is about 41 degrees F.

In a typical profile of the Huckleberry soil the surface is covered by about 3 inches of coniferous needles and twigs. The upper 16 inches of the subsoil is yellowish brown and light yellowish brown, medium acid silt loam. The lower 10 inches of the subsoil is pale brown, medium acid gravelly silt loam. The substratum is very pale brown, medium acid very gravelly loam about 10 inches thick. Weathered metasedimentary bedrock is at a depth of about 36 inches.

The Ardenvoir soil is suited to the production of Douglas-fir, grand fir and western larch. It is capable of producing about 5,900 cubic feet per acre 0.6 inch and more in diameter or 18,500 board feet (Scribner rule) of the merchantable timber 11.6 inches and more in diameter from an unmanaged stand of 80 year old trees. Very steep slopes and the very high hazard of erosion restrict the use of the Ardenvoir soil for timber production. Specialized equipment and logging operations are needed to keep soil losses to a minimum. Carefully managed reforestation after harvest reduces plant competition of undesirable understory plants. The exposure of large areas of soil and logging during the rainy winter and spring need to be avoided.

The Ardenvoir soil has potential for grazing where the tree canopy is opened by logging, fire, or some other disturbance. Seeding disturbed areas of this soil to adapted grasses increases ground cover and helps protect the soil. Important forage plants on this soil are elk sedge, mountain maple, and red-stem ceanothus. Creambush oceanspray and mallow ninebark, two relatively unpalatable shrubs, tend to dominate the vegetation once the canopy is opened. Management of vegetation should be designed to protect timber regeneration and to insure adequate litter for soil protection.

The Ardenvoir soil produces forage for livestock and big game for 20 to 30 years following opening of the canopy. During this period, the total annual production varies from about 1,800 pounds of air-dry forage per acre to less than 200 pounds per acre as the canopy closes. Very steep slopes severely limit livestock movement and the accessibility of the forage.

The Huckleberry soil is suited to the production of western redcedar, Douglas-fir, grand fir, western larch, lodgepole pine, and western white pine. It is capable of producing about 10,350 cubic feet per acre 0.6 inch and more in diameter or 34,600 board feet (Scribner rule) of merchantable timber 12.6 inches and more in diameter from an unmanaged stand of 80 year old trees. Very steep slopes and the very high hazard of erosion restrict the use of the Huckleberry soil for timber production. Specialized equipment and logging operations are necessary to minimize soil losses. The exposure of large areas of soil and logging during the rainy winter and spring needs to be avoided.

The Huckleberry soil has potential for grazing where the tree canopy is opened by logging or fire. Seeding disturbed areas of the soil to adapted grasses increases ground cover and helps protect the soil. Important forage plants on this soil are seeded grasses, elk sedge, willow, mountain maple, and red-stem ceanothus. Management of vegetation should be designed to protect timber regeneration and to insure adequate litter for soil protection.

The Huckleberry soil produces forage for livestock and big game for 10 to 15 years following opening of the canopy. During this period, annual production varies from about 2,200 pounds of air-dry forage per acre to less than 150 pounds per acre as the canopy closes. Very steep slopes severely limit livestock movement and the accessibility of the forage.

Areas of the map unit provide woodland habitat for such wildlife as white-tailed deer, elk, black bear, chipmunks, squirrels, and forest grouse.

The slope and depth to rock are limitations for the construction of homes, cabins, and roads. The amount of site preparation needed for construction on these soils is a limitation. Very steep slopes and dust are limitations to the use of these soils for such recreational developments as trails and camp areas. These soils need a good vegetation cover to help keep soil losses to a minimum and to maintain their watershed potential. Careful management of the timber resource and understory vegetation is essential to the sustained production and use of these soils. Both soils in capability subclass VIIe.

4-Ardenvoir-McCrosket association, steep. This map unit consists of steep soils on mountain side slopes at elevations between about 2,500 to 4,000 feet. It is about 55 percent Ardenvoir gravelly loam, 20 to 35 percent slopes, and 30 percent McCrosket gravelly silt loam, 20 to 35 percent slopes. The Ardenvoir soil has northerly exposures and concave slopes. It supports a grand fir-pachistima plant community. The McCrosket soil has southerly exposures and is on ridgetops. It supports a Douglas-fir-ninebark plant community.

Included with these soils in mapping are areas of Huckleberry silt loam, Santa silt loam, Tekoa shaly silt loam, and Taney silt loam. These included soils make up about 15 percent of the map unit.

The Ardenvoir soil is deep and well drained over weathered metasedimentary bedrock. It formed in material weathered from metasediment rock and a loess mantle containing volcanic ash. Permeability is moderate. Effective rooting depth is 40 to 60 inches. Available water capacity is 4 to 6 inches. Surface runoff is rapid, and the hazard of erosion is high. The average annual precipitation is about 29 inches, including 5 to 10 feet of snow. Average annual air temperature is about 42 degrees F.

In a typical profile of the Ardenvoir soil the surface layer is brown and light yellowish brown, neutral a ad slightly acid gravelly loam about 9 inches thick. The subsoil is very pale brown, slightly acid gravelly loam about 8 inches thick. The substratum is very pale brown, medium acid very cobbly loam and very flaggy loam about 29 inches thick. Weathered metasedimentary bedrock is at a depth of 46 inches.

The McCrosket soil is deep and well drained over weathered metasedimentary bedrock. It formed in loess and material that weathered from the metasediment rock.

Permeability is moderate. Effective rooting depth is 40 to 60 inches. The available water capacity is 4 to 5 inches. Surface runoff is rapid, and the hazard of erosion is high. The average annual precipitation is about 25 inches. The average annual air temperature is about 47 degrees F.

In a typical profile of the McCrosket soil the surface layer is dark grayish brown and brown, neutral gravelly silt loam about 11 inches thick. The subsoil is light yellowish brown and very pale brown, medium acid very gravelly silt loam and very stony silt loam about 31 inches thick. Weathered metasedimentary bedrock is at a depth of about 42 inches.

The soils in this map unit are used for timber production, grazing, wildlife habitat, and watershed.

The Ardenvoir soil is suited to the production of grand fir, Douglas-fir, and western larch. It is capable of producing about 5,900 cubic feet per acre 0.6 inch and more in diameter of 18,500 board feet (Scribner rule) of merchantable timber 11.6 inches and more in diameter from an unmanaged stand of 80 year old trees. Steep slopes and the high hazard of erosion restrict the use of the Ardenvoir soil for timber production. Trees can be harvested by conventional methods, but landings, logging roads, and skid trails must be carefully planned to minimize soil losses. Carefully managed reforestation after harvest reduces plant competition of undesirable understory plants.

The Ardenvoir soil has potential for grazing where the tree canopy is opened by logging, fire, or some other disturbance. Seeding disturbed areas of this soil to adapted grasses increases forage production and helps protect the soil. Important forage plants are elk sedge, mountain maple, and red-stem ceanothus. Creambush oceanspray and mallow ninebark, two relatively unpalatable shrubs, tend to dominate the vegetation once the canopy is opened. Management of vegetation should be designed to protect timber regeneration and to insure adequate litter for soil protection.

The Ardenvoir soil produces forage for livestock and big game for 20 to 30 years following opening of the canopy. During this period, the total annual production varies from about 1,800 pounds of air-dry forage per acre to less than 200 pounds per acre as the canopy closes.

The McCrosket soil is suited to the production of Douglas-fir and ponderosa pine. It is capable of producing about 5,900 cubic feet per acre 0.6 inch and more in diameter of 18,500 board feet (Scribner rule) of merchantable timber 11.6 inches and more in diameter from an unmanaged stand of 80 year old trees. Steep slopes and the high hazard of erosion restrict the use of the McCrosket soil for timber production. Trees can be harvested by using conventional methods, but logging roads, skid trails, and landings must be planned to minimize soil losses.

The McCrosket soil has potential for grazing where the tree canopy is opened by logging, fire, or some other disturbance. Seeding disturbed areas of this soil to adapted grasses increases forage production and helps protect the soil. Important forage plants are the seeded grasses, bluebunch wheatgrass, bluegrass, elk sedge, and willow. Creambush oceanspray and mallow ninebark, two relatively unpalatable shrubs, tend to dominate the vegetation once the canopy is opened. Management of vegetation should be designed to protect timber regeneration and to insure adequate litter for soil protection.

The McCrosket soil produces forage for livestock and big game for 20 to 30 years following opening of the canopy. During this period, the total annual production varies from about 1,500 pounds of air-dry forage per acre to less than 200 pounds per acre as the canopy closes.

Areas of these soils provide woodland wildlife habitat for white-tailed deer, elk, black bear, chipmunks, squirrels, and forest grouse.

Slopes, stones, and depth to bedrock are limitations for the construction of homes, cabins, and roads. The amount of site preparation needed for construction is a limitation. Slope, dust, and small stones are limitations for such recreational developments as trails and camp areas. Both soils in capability subclass VIe.

5-Ardenvoir-McCrosket association, very steep. This map unit consists of very steep soils on mountain side slopes at elevations of 2,500 to 4,000 feet. It is about 75 percent Ardenvoir gravelly loam, 35 to 65 percent slopes, and 20 percent McCrosket gravelly silt loam, 35 to 65 percent slopes. The Ardenvoir soil has northerly exposures and concave slopes. It supports a grand fir-pachistima plant community. The McCrosket soil has southerly exposures and is on 'ridgetops. It supports a Douglas-fir-ninebark plant community.

Included with these soils in mapping are areas of Tekoa shaly silt loam and Huckleberry silt loam. These included soils make up about 5 percent of the map unit.

The Ardenvoir soil is deep and well drained over weathered metasedimentary bedrock. It formed in material weathered from metasediment rock with a mantle of loess containing volcanic ash. Permeability is moderate. Effective rooting depth is 40 to 60 inches. Available water capacity is 4 to 6 inches. Surface runoff is very rapid, and the hazard of erosion is very high. The average annual precipitation is about 29 inches, including 5 to 10 feet of snow. Average annual air temperature is about 42 degrees F.

In a typical profile of the Ardenvoir soil the surface layer is brown and light yellowish brown, neutral and slightly acid gravelly loam about 9 inches thick. The subsoil is very pale brown,, slightly acid gravelly loam about 8 inches thick. The substratum is very pale brown, medium acid very cobbly loam and very flaggy loam about 29 inches thick. Weathered metasedimentary bedrock is at a depth of 46 inches.

The McCrosket soil is deep and well drained over weathered metasedimentary bedrock. It formed in loess and material weathered from the metasediment rock. Permeability is moderate. Effective rooting depth is 40 to 60 inches. The available water capacity is 3 to 5 inches. Surface runoff is very rapid, and the hazard of erosion is very high. The average annual precipitation is about 25 inches. Average annual air temperature is about 47 degrees F.

In a typical profile of the McCrosket soils the surface layer is dark grayish brown and brown, neutral gravelly silt loam about 11 inches thick. The subsoil is light yellowish brown and very pale brown, medium acid very gravelly silt loam and very stony silt loam about 31 inches thick. Weathered metasedimentary bedrock is at a depth of about 42 inches.

The soils in this map unit are used mainly for timber production, wildlife habitat, and watershed.

The Ardenvoir soil is suited to the production of Douglas-fir, grand fir, and western larch. It is capable of producing about 5,900 cubic feet per acre 0.6 inch and more in diameter or 18,500 board feet (Schribner rule) of merchantable timber 11.6 inches and more in diameter from an unmanaged stand of 80 year old trees. Very steep slopes and the very high hazard of erosion restrict the use of the Ardenvoir soil for timber production. Special equipment and special methods in logging operations are needed to keep soil losses to a minimum. Carefully managed reforestation after harvest reduces plant competition. Exposing large areas of soil and logging during winter and spring need to be avoided.

The Ardenvoir soil has potential for grazing where the tree canopy is opened by logging, fire, or some other disturbance. Seeding disturbed areas of this soil to adapted grasses increases the vegetation cover and helps protect the soil. Important forage plants are seeded grasses, elk sedge, mountain maple, and red-stem ceanothus. Creambush oceanspray and mallow ninebark, two relatively unpalatable shrubs, tend to dominate the vegetation once the canopy is opened. Management of vegetation should be designed to protect timber regeneration and to insure adequate litter and plant cover for soil protection.

The Ardenvoir soil produces forage for 20 to 30 years following opening of the canopy. During this period, the total annual production varies from about 1,800 pounds of air-dry forage per acre to less than 200 pounds per acre as the canopy closes. Slopes severely limit livestock movement and accessibility of the forage.

The McCrosket soil is suited to the production of Douglas-fir and ponderosa pine. It is capable of producing about 7,100 cubic feet per acre 0.6 inch and more in diameter of 26,000 board feet (Scribner rule) of merchantable timber 11.6 inches and more in diameter from an unmanaged stand of 80 year old trees. Very steep slopes and the very high hazard of erosion restrict the use of the McCrosket soil for timber production. Special equipment and logging operations are needed in tree harvest to keep soil losses to a minimum.

The McCrosket soil has potential for grazing where the tree canopy is opened by logging, fire, or some other disturbance. Seeding disturbed areas of this soil to adapted grasses increases the vegetation cover and helps protect the soil. Important forage plants are seeded grasses, bluebunch wheatgrass, bluegrass, elk sedge, and willow. Creambush oceanspray and mallow ninebark, two relatively unpalatable shrubs, tend to dominate the vegetation once the canopy is opened. Management of vegetation should be designed to protect timber regeneration and to insure adequate litter and plant cover for soil protection.

The McCrosket soil produces forage for 20 to 30 years following opening of the canopy. During this period, the total annual production varies from about 1,500 pounds of air-dry herbage per acre to less than 200 pounds per acre as the canopy closes.

Areas of these soils provide woodland wildlife habitat for white-tailed deer, elk, black bear, chipmunks, squirrels, and forest grouse.

Very steep slopes, stones, and depth to bedrock are limitations for the construction of homes, cabins, and roads. The extensive site preparation needed on these soils is a major limitation in construction. Very steep slopes, dust, and small stones are the main limitations for such recreational developments as trails and camp areas. Both soils in capability subclass VIIe.

6-Benewah-Rasser complex, 5 to 20 percent slopes. These rolling and hilly soils are mostly on mountain foot slopes at elevations of 2,800 to 3,500 feet. They formed in loess-covered mud flows. The average annual precipitation is about 28 inches, including 3 to 6 feet of snow. Average annual air temperature is about 43 degrees F.

Benewah silt loam, 5 to 20 percent slopes, makes up about 60 percent of the map unit, and Rasser silt loam, 5 to 20 percent slopes, makes up about 35 percent. These soils support a grand fir-pachistima plant community. The Benewah soil is in concave areas, and the Rasser soil is on the higher parts of slopes.

Included with these soils in mapping is Santa silt loam. This included soil makes up 5 percent of the map unit.

The Benewah soil is very deep and moderately well drained. It has a perched water table at a depth of 6 to 18 inches from February through April. Permeability is slow. Effective rooting depth is 60 inches, and available water capacity is 11 to 13 inches. Surface runoff is rapid, and the hazard of erosion is high.

In a typical profile of the Benewah soil the surface layer is light brownish gray, light yellowish brown and very pale brown, medium acid and strongly acid silt loam about 18 inches thick. The subsoil is brown, medium acid to very strongly acid silty clay loam to a depth of 60 inches.

The Rasser soil is deep and well drained. Permeability is moderately slow. Effective rooting depth is 60 inches, and available water capacity is 6 to 8 inches. Surface runoff is rapid, and the hazard of erosion is high.

In a typical profile of the Rasser soil the surface layer is pale brown and light yellowish brown, strongly acid and very strongly acid silt loam about 12 inches thick. The subsoil is pale brown, light yellowish brown and very pale brown, very strongly acid clay loam, very cobbly clay loam, and very gravelly clay loam to a depth of 60 inches.

The soils in this map unit are used mainly for woodland, wildlife habitat, and recreation. Some areas have been cleared and are used for pasture or hay. A small acreage is used for dryfarmed wheat and barley. Cultivation is hazardous because of the rolling to hilly slopes and the high hazard of erosion. Cultivation is also limited to fall because of the perched water table that is in the Benewah soil during spring. Contour cultivation helps reduce soil losses.

The Benewah and Rasser soils are better suited to the production of grand fir, Douglas-fir, western larch, ponderosa pine, and lodgepole pine than to most other uses. These soils are capable of producing about 9,000 cubic feet per acre 0.6 inch and more in diameter or 17,900 board feet (Scribner rule) of merchantable timber 12.6 inches and more in diameter from an unmanaged stand of 80 year old trees. Plant competition is a concern in reforestation after timber harvest. Careful management is needed to reduce plant competition of undesirable understory plants. Trees can be harvested by conventional methods.

The Benewah and Rasser soils have potential for grazing where the tree canopy is opened by logging, fire, or some disturbance. Seeding disturbed areas of these soils to adapted grasses increases forage production and helps protect the soils. Important forage plants are bluegrass, elk sedge, hawkweed, Sandberg peavine, willow, and redstem ceanothus. Creambush oceanspray and mallow ninebark, two relatively unpalatable shrubs, tend to dominate the vegetation once the canopy is opened. Management of vegetation should be designed to protect timber regeneration and to insure adequate litter for soil protection.

The soils in this map unit produce forage for 15 to 25 years following opening of the canopy. During this period, the total annual production varies from about 2,200 pounds of air-dry forage per acre to less than 200 pounds per acre as the canopy closes.

The Benewah and Rasser soils have potential as woodland wildlife habitat for white-tailed deer, forest grouse, and songbirds.

The moderately slow and slow permeability of the soils restrict their use for septic tank absorption fields. The Benewah soil is also restricted by a perched water table during spring. Building and road designers must consider slope, strength of the soil, and frost damage. Building footings need to be placed below the depth of frost penetration. Capability subclass VIe.

7-Benewah-Rasser complex, 20 to 35 percent slopes. These hilly to steep soils are mostly on mountain foot slopes at elevations of 2,800 to 3,500 feet. They formed in loess-covered mud flows. The average annual precipitation is about 28 inches, including 3 to 6 feet of snow, and average annual air temperature is about 43 degrees F.

Benewah silt loam, 20 to 35 percent slopes, makes up about 60 percent of the map unit, and Rasser silt loam, 20 to 35 percent slopes, makes up about 35 percent. These soils support a grand fir-pachistima plant community. The Benewah soil is in concave areas, and the Rasser soil is on the highest parts of slopes.

Included with these soils in mapping is Santa silt loam. This included soil makes up 5 percent of the map unit.

The Benewah soil is very deep and moderately well drained. It has a perched water table at a depth of 6 to 18 inches from February to April. Permeability is slow. Effective rooting depth is 60 inches, and available water capacity is 11 to 13 inches. Surface runoff is very rapid, and the hazard of erosion is very high.

In a typical profile of the Benewah soil the surface layer is light brownish gray, light yellowish brown and very pale brown, medium acid and strongly acid silt loam about 18 inches thick. The subsoil is brown, medium acid to very strongly acid silty clay loam to a depth of 60 inches.

The Rasser soil is deep and well drained. Permeability is moderately slow. Effective rooting depth is 60 inches, and available water capacity is 6 to 8 inches. Surface runoff is very rapid, and the hazard of erosion is very high.

In a typical profile of the Rasser soil the surface layer is pale brown and light yellowish brown, strongly acid and very strongly acid silt loam about 12 inches thick. The subsoil is pale brown, light yellowish brown, and very pale brown, very strongly acid clay loam, very cobbly clay loam, and very gravelly clay loam about 48 inches thick.

The soils in this unit are used mainly for woodland, wildlife habitat, and recreation. Some of the less sloping areas have been cleared and are used for pasture or hay.

The Benewah and Rasser soils are suited to the production of grand fir, Douglas-fir, western larch, ponderosa pine, and lodgepole pine. These soils are capable of producing about 9,000 cubic feet per acre 0.6 inch and more in diameter or 17,900 board feet (Scribner rule) or merchantable timber 12.6 inches and more in diameter from an unmanaged stand of 80 year old trees. Plant competition and steep slopes restrict the use of these soils for timber production. Trees can be harvested by conventional methods, but logging roads, skid trails, and landings must be planned to minimize soil losses. Carefully managed reforestation after harvest reduces plant competition of undesirable understory plants.

The Benewah and Rasser soils have potential for grazing where the tree canopy is opened by logging, fire, or some other disturbance. Seeding disturbed areas of these soils to adapted grasses increases forage production and helps protect the soil. Important forage plants are seeded grasses, bluegrass, elk sedge, hawkweed, Sandberg peavine, willow, and red-stem ceanothus. Creambush oceanspray and mallow ninebark, two relatively unpalatable shrubs, tend to dominate the vegetation once the canopy is opened. Management of vegetation should be designed to protect the timber regeneration and to insure adequate litter for soil protection.

The Benewah and Rasser soils produce forage for 15 to 25 years following opening of the canopy. During this period, the total annual production varies from about 2,200 pounds of air-dry forage per acre to less than 200 pounds per acre as the canopy closes.

These soils have potential as woodland wildlife habitat for white-tailed deer, forest grouse, and many songbirds.

The Benewah and Rasser soils have severe restrictions for septic tank absorption fields because of steep slopes and moderately slow and slow permeability. The Benewah soil is also restricted by a perched water table during spring. Slopes, low soil strength, and potential frost action limit building and road construction. Capability subclass VIe.

8-Blinn stony loam, 5 to 35 percent slopes. This rolling to steep soil is moderately deep and well drained. It is on escarpments and foot slopes at elevations of 2,100 to 3,200 feet. It formed in a thin mantle of loess and volcanic ash over basalt colluvium and residuum. The plant community is grand fir-pachistima. The average annual precipitation is about 26 inches. Average annual air temperature is about 43 degrees F.

Included with this soil in mapping are small areas of Bobbitt stony loam, Dorb silt loam, and Lacy stony loam. These included soils have slopes of 5 to 35 percent.

This soil has moderate permeability. Effective rooting depth is 20 to 40 inches, and available water capacity is about 4 or 5 inches. Surface runoff is medium to rapid, and the hazard of erosion is high.

In a typical profile the surface layer is light brownish gray and pale brown, neutral stony loam about 10 inches thick. The subsoil is pale brown, neutral stony loam about 12 inches thick. The substratum is pale brown, neutral very stony loam about 17 inches thick. Fractured basalt is at a depth of about 39 inches.

Most areas of this soil are in woodland or are used as wildlife habitat. Small areas are used for recreation, and a few areas have been cleared and are used for pasture.

This soil is suited to the production of grand fir, Douglas-fir, ponderosa pine, western larch, and lodgepole pine. It is capable of producing about 10,350 cubic feet per acre 0.6 inch and more in diameter or 34,600 board feet (Scribner rule) of merchantable timber 12.6 inches and more in diameter from an unmanaged stand of 80 year old trees. Stones and the very high hazard of erosion restrict the use of this soil for timber production. Trees can be harvested by conventional methods, but logging roads, skid trails, and landings require careful planning to reduce soil losses. Carefully managed reforestation after harvest reduces plant competition of undesirable understory plants.

The Blinn soil has potential for grazing, especially where canopy has been opened by logging or fire. Seeding disturbed areas of this soil to grass increases forage production. Important forage plants are seeded grasses, elk sedge, bluebunch wheatgrass, blue wildrye, Columbia brome, and willow. Shrubs can dominate the vegetation once the canopy is opened. Management of vegetation should be designed to protect timber regeneration and to increase production of grasses.

This soil produces forage continually under a managed woodlot. If not managed, forage is produced for 20 to 30 years. The total annual production varies from 1,800 pounds of air-dry forage per acre to 200 pounds per acre as the canopy closes. Areas of this soil provide woodland wildlife habitat for white-tailed deer, black bear, elk, forest grouse, songbirds, and squirrels.

Slopes, depth to bedrock, and stoniness are limitations for homesites, road construction, and recreation. Capability subclass VIs.

9-Blinn stony loam, 35 to 65 percent slopes. This steep soil is moderately deep and well drained. It is on escarpments and foot slopes at elevations of 2,100 to 3,200 feet. It formed in basalt colluvium and a thin mantle of loess and volcanic ash over basalt colluvium and residuum. The plant community is grand fir-pachistima. The average annual precipitation is about 26 inches. Average annual air temperature is about 43 degrees F.

Included with this soil in mapping are small areas of Bobbitt stony loam and Lacy stony loam. These included soils have slopes of 35 to 65 percent.

This soil has moderate permeability. Effective rooting depth is 20 to 40 inches, and available water capacity is about 4 or 5 inches. Organic matter content in the surface layer is low. Surface runoff is very rapid, and the hazard of erosion is very high.

In a typical profile the surface layer is light brownish gray and pale brown, neutral stony loam about 10 inches thick. The subsoil is pale brown, neutral stony loam about 12 inches thick. The substratum is pale brown, neutral very stony loam about 17 inches thick. Fractured basalt rock is at a depth of about 39 inches.

This soil is used mainly as woodland and wildlife habitat because of the very steep slopes. Some areas are used for recreation.

This soil is suited to the production of grand fir, Douglas-fir, ponderosa pine, western larch, and lodgepole pine. It is capable of producing about 10,350 cubic feet per acre 0.6 inch and more in diameter or 34,600 board feet (Scribner rule) of merchantable timber 12.6 inches and more in diameter from an unmanaged stand of 80 year old trees. Steep slopes, stones, and the very high hazard of erosion restrict the use of this soil for timber production. Use of special equipment and logging operations that cause a minimum of soil disturbance are needed. Carefully managed reforestation after harvest reduces plant competition of undesirable understory plants.

This Blinn soil has limited potential for grazing where the canopy has been opened by logging or fire. Seeding disturbed areas of this soil to grass increases forage production. Slopes limit livestock movement and forage accessibility. Important forage plants are seeded grasses, elk sedge, bluebunch wheatgrass, blue wildrye, Columbia brome, and willow. Shrubs can dominate the vegetation once the canopy is opened. Management of vegetation should be designed to protect timber regeneration and to increase production of grasses.

This soil produces forage continually under a managed woodlot. If not managed, forage is produced for 20 to 30 years. The total annual production varies from 1,800 pounds of air-dry forage per acre to 200 pounds per acre as the canopy closes.

Areas of this soil provide woodland wildlife habitat for white-tailed deer, black bear, elk, forest grouse, songbirds, and squirrels.

Steep slopes and stoniness are limitations for recreation uses. Slopes, depth to bedrock, and stoniness are limitations for homesite and road construction. The extensive site preparation needed because of the steep slope is a major limitation to construction of this soil. Capability subclass VIIs.

10-Blinn-Bobbitt association. This map unit consists of very steep soils on escarpments and foot slopes of basaltic plains at elevations of 2,100 to 3,200 feet. It is about 40 percent Blinn stony loam and 25 percent Bobbitt stony loam. These soils have slopes of 35 to 65 percent. The Blinn soil has mostly north-facing slopes. It supports a grand fir-pachistima plant community. The Bobbitt soil has mostly south-facing slopes. It supports a Douglas-fir-snowberry plant community.

Included with these soils in mapping are areas of Lacy stony loam, 35 to 65 percent slopes, Dorb silt loam, 5 to 65 percent slopes, Rock outcrop, and Rubble land. These included soils make up 35 percent of the map unit.

The Blinn soil is moderately deep and well drained over basalt. It formed in a thin mantle of loess that is high in volcanic ash over basalt colluvium and residuum. Permeability is moderate. Effective rooting depth is 20 to 40 inches, and available water capacity is about 4 or 5 inches. Surface runoff is very rapid, and the hazard of erosion is very high. The average annual precipitation is about 26 inches, including 2 to 4 feet of snow. Average annual air temperature is about 43 degrees F.

In a typical profile of the Blinn soil the surface layer is light brownish gray and pale brown, neutral stony loam about 10 inches thick. The subsoil is pale brown, neutral stony loam about 12 inches thick. The substratum is pale brown, neutral very stony loam about 17 inches thick. Fractured basalt is at a depth of about 39 inches.

The Bobbitt soil is moderately deep and well drained over basalt. It formed in a thin mantle of loess and volcanic ash over basalt residuum and colluvium. Permeability is moderate. Effective rooting depth is 20 to 40 inches, and available water capacity is 2 or 3 inches. Surface runoff is very rapid, and the hazard of erosion is very high. The average annual precipitation is about 25 inches. Average annual air temperature is about 47 degrees F.

In a typical profile of the Bobbitt soil, the surface layer is brown, neutral stony loam about 4 inches thick. The subsoil is brown, neutral very stony clay loam about 17 inches thick. Fractured basalt is at a depth of about 21 inches.

The Blinn soil is suited to the production of grand fir, Douglas-fir, ponderosa pine, western larch, and lodgepole pine. It is capable of producing about 10,350 cubic feet per acre 0.6 inch and more in diameter or 34,600 board feet (Scribner rule) of merchantable timber 12.6 inches and more in diameter from an unmanaged stand of 80 year old trees. Steep slopes, stones, and the very high hazard of erosion restrict the use of the Blinn soil for timber production. Use of special equipment and logging operations that cause a minimum of soil disturbance is needed. Carefully managed reforestation after harvest reduces plant competition of undesirable understory plants.

The Bobbitt soil is suited to the production of Douglas-fir and ponderosa pine. It is capable of producing about 5,900 cubic feet per acre 0.6 inch and more in diameter or 18,500 board feet (Scribner rule) of merchantable timber 11.6 inches and more in diameter from an unmanaged stand of 80 year old trees. Steep slopes, the depth to bedrock, and the high hazard of erosion restrict the use of the Bobbitt soil for timber production. Specialized equipment and logging operations that cause minimum soil disturbance are needed in tree harvest.

The Blinn soil has some potential for grazing, especially where the canopy has been opened by logging or fire. Seeding disturbed areas of this soil to adapted grasses increases the vegetation cover. Important forage plants are seeded grasses, elk sedge, bluebunch wheatgrass, blue wildrye, Columbia brome, bluegrass, and willow. Shrubs can dominate the vegetation once the canopy is opened. Management of vegetation should be designed to protect timber regeneration and to increase production of grasses.

The Blinn soil produces forage for livestock and big game animals continually under a managed woodland. The total annual production varies from 1,800 pounds per acre of air-dry forage to 200 pounds per acre as the canopy closes. Slopes of more than 35 percent limit livestock movement and forage accessibility.

The Bobbitt soil has potential for grazing, especially where the canopy has been opened by logging or fire. Seeding disturbed areas of this soil to adapted grasses increases the vegetation cover. Important forage plants are Idaho fescue, bluebunch wheatgrass, bluegrass, American vetch, rose, and seeded grasses. Shrubs can dominate the vegetation once the canopy is opened. Management of vegetation should be designed to protect timber regeneration and to increase production of Idaho fescue and bluebunch wheatgrass.

The Bobbitt soil produces forage for livestock and big game animals continually under a managed woodland. The total annual production varies from 1,500 pounds of air-dry forage to 400 pounds per acre as the canopy closes.

The Blinn and Bobbitt soils provide woodland wildlife habitat for white-tailed deer, black bear, squirrels, chipmunks, forest grouse, and songbirds.

These soils must be managed to keep soil losses to a minimum, thus maintaining their watershed potential. The main concern in meeting this goal is careful management of the timber resource and understory vegetation.

Very steep slopes limit the construction of homesites and roads. Both soils in capability subclass VIIs.

11-Brickel-Rubble land association. This map unit consists of sloping to steep soils on mountain ridgetops and in areas of stones and boulders at elevations from 4,500 to 6,500 feet. It is about 60 percent Brickel cobbly loam, 5 to 45 percent slopes, and 25 percent Rubble land. The Brickel soil has convex slopes and is on all exposures. It supports a plant community of subalpine fir-beargrass. The Rubble land consists of areas of stones and boulders and is virtually free of vegetation.

Included in mapping of this unit are areas of Brickel stony loam, 45 to 75 percent slopes. This included soil makes up about 15 percent of the map unit.

The Brickel soil is moderately deep and well drained over weathered granitic bedrock. It formed in loess and volcanic ash mantle over residuum and colluvium derived from granitic bedrock. Permeability is moderate. Effective rooting depth is 20 to 40 inches, and available water capacity is 1 to 3 inches. Surface runoff is rapid to very rapid, and the hazard of erosion is very high. The average annual precipitation is about 40 inches, including about 10 feet of snow. Average annual air temperature is about 40 degrees F.

In a typical profile the surface layer is dark grayish brown, strongly acid cobbly loam about 3 inches thick. The subsoil is dark brown, strongly acid very cobbly loam about 5 inches thick. The substratum is light yellowish brown, medium acid very cobbly loam about 16 inches thick. Weathered granitic bedrock is at a depth of about 24 inches.

Brickel soils are valuable for watershed, recreation, some limited grazing, and woodland. The high elevation, short growing season, and large number of stones and cobbles limit vegetation growth.

The Brickel soil is suited to the production of subalpine fir and Engelmann spruce. It is capable of producing about 6,500 cubic feet per acre 0.6 inch and more in diameter of 2,300 board feet (Scribner rule) of merchantable timber 12.6 inches and more in diameter from an unmanaged stand of 80 year old trees. Steep slopes, the windthrow hazard, and stones on the surface restrict the use of the Brickel soil for timber production. Logging roads are difficult to construct and maintain because of the depth to bedrock and the tendency for roadbanks to slump and slide. Trees can be harvested by special equipment and logging operations.

The Brickel soil has some value for grazing by domestic livestock where the stand has been opened by fire or by logging. The grazing should be limited to summer when the soil is dry and the forage plants have achieved almost full growth. Important forage plants for livestock are Idaho fescue, bromegrass, and sedges. Grazing management should be designed to protect tree regeneration and to maintain adequate plant cover and litter to protect the soil.

The Brickel soil produces forage for livestock and big game animals for 15 to 20 years following opening of the canopy. During this period, the total annual production varies from about 1,200 pounds per acre of air-dry forage to less than 150 pounds per acre as the canopy closes.

The Brickel soil has some potential as woodland wildlife habitat for white-tailed deer, elk, black bear, chipmunks, squirrels, and forest grouse.

This map unit is not used for homesites because of steep slopes, depth to bedrock, and inaccessibility. Roads must be built with low slope gradients to minimize soil losses and soil slumps on unprotected cutbanks. Steep slopes and stones on the surface restrict the use of the Brickel soil for recreational use.

Rubble land consists of areas of large stones and boulders that are virtually free of vegetation, except for lichens. These areas are not suitable for timber production, wildlife habitat, roads, or homesite development.

The Brickel soil must be managed to keep soil losses to a minimum, thus maintaining their watershed potential. The main concern in meeting this goal is careful management of the vegetation. Brickel soil in capability subclass VIs, Rubble land in capability subclass VIIIs.

12-Cald silt loam. This soil is very deep and somewhat poorly drained. It is in large drainageways at elevations of 2,125 to 3,500 feet. Slopes are 0 to 2 percent. This soil formed in alluvium derived mainly from loess with a variable amount of volcanic ash. The average annual precipitation is about 20 inches. Average annual air temperature is about 47 degrees F.

Included with this soil in mapping are small areas of Latahco silt loam and Lovell silt loam that have slopes of 0 to 2 percent and Thatuna silt loam that has slopes of 2 to 5 percent.

This soil has moderately slow permeability. Effective rooting depth is 60 inches. Available water capacity is about 11 to 18 inches. This soil has a seasonal high water table at a depth of 36 to 60 inches from November to June. It is commonly flooded for brief periods early in spring. Surface runoff is very slow, and the hazard of erosion is slight.

In a typical profile the surface layer is dark grayish brown, medium acid silt loam 25 inches thick. The substratum is mottled, gray and very dark grayish brown, slightly acid silt loam to a depth of 60 inches.

This soil is used for production of small grain, peas, hay, lentils, pasture, and grass seed. Peas and lentils are occasionally damaged by frost. This soil is well adapted to a continuous cropping system, and production is good when crops are adequately fertilized. Wheat and barley are the most common crops. Use of crop residue and continuous cropping keep soil losses to a minimum. Applications of nitrogen, sulfur, and occasional phosphorus are needed in all cropping systems. Alfalfa is short-lived because of the seasonal high water table. Land smoothing is very desirable for surface water removal in some areas.

The Cald soil has potential as openland and rangeland wildlife habitats and some potential as wetland wildlife habitat. If it is cultivated, this soil is suited to such upland game birds as Hungarian partridge, ring-necked pheasant, mourning dove, and quail. It also provides habitat for songbirds and starlings. These birds obtain their food mainly from cropland. Shrubs and other plants that improve wildlife habitat can be planted along ditchbanks and fence rows and in odd field corners.

Natural vegetation is mostly basin wildrye, silver lupine, iris, blue camas, sedges, snowberry, tufted hairgrass, willow, and hawthorn.

The hazard of flooding, a seasonal water table, the limited ability of the Cald soil to support a load, and a high potential frost action are limitations for urban development. Homes or roads that are built on this soil must be designed to offset these limitations. Flooding, moderately slow permeability, and the seasonal high water table are concerns if this soil is used for septic tank absorption fields. Contamination of the ground water supply is also a hazard. Capability subclass IIw.

13-Cald-Thatuna silt loams, 0 to 7 percent slopes. These level and sloping soils are in and along large drainageways of loess plains at elevations of 2,125 to 3,500 feet. Cald silt loam makes up about 55 percent of the map unit and Thatuna silt loam about 25 percent. The average annual precipitation is about 20 inches. Average annual air temperature is about 47 degrees F. The Cald soil is in large drainageways and has slopes of 0 to 2 percent. Thatuna soil is adjacent to the Cald soil on both sides of the drainageways and has slopes of 3 to 7 percent.

Included with these soils in mapping is Latahco silt loam and Lovell silt loam. These included soils make up about 20 percent of the map unit.

The Cald soil is very deep and somewhat poorly drained. It formed in alluvium derived from loess with volcanic ash. Permeability is moderately slow. Effective rooting depth is 60 inches when the soil is drained, available water capacity is about 11 to 13 inches. This soil has a seasonal high water table at a depth of 36 to 60 inches from November to June. It is commonly flooded for brief periods early in spring. Surface runoff is very slow, and the hazard of erosion is slight.

In a typical profile of the Cald soil the surface layer is dark grayish brown, medium acid silt loam about 25 inches thick. The substratum extends to a depth of 60 inches. It is mottled, gray and very dark grayish brown, slightly acid silt loam.

The Thatuna soil is very deep and moderately well drained. It formed in deep loess with a small amount of volcanic ash. Permeability is slow. Effective rooting depth is 60 inches, and available water capacity is 11 to 13 inches. Surface runoff is medium, and the hazard of erosion is moderate. A perched water table is at a depth of 36 to 48 inches from February to April.

In a typical profile of the Thatuna soil the surface layer is dark grayish brown, neutral silt loam about 19 inches thick. The subsoil is brown, slightly acid silt loam about 8 inches thick. The buried subsurface layer is pale brown and very pale brown, slightly acid silt loam 10 inches thick. The buried subsoil is light yellowish brown and yellowish brown, slightly acid and neutral silt loam and silty clay loam to a depth of 60 inches.

Cald and Thatuna soils are suited to the production of small grain, pasture, and grass seed. The wetness of the Cald soil can limit crop choices but generally can be corrected by drainage if suitable outlets can be provided (fig. 4).

Continuous grain can be grown in various rotations with peas or lentils. Minimum tillage and use of crop residue are adequate for erosion control. Land smoothing and subsurface drainage help to control seepage and surface water. Hay or pasture is especially well adapted on these wet soils and provides residue for maintenance of organic matter. Applications of nitrogen, sulfur, and occasional phosphorus fertilizer are necessary in all cropping systems.

Thatuna and Cald soils have potential as openland and rangeland wildlife habitats, and the Cald soil has some potential as wetland wildlife habitat. Cultivated soils are suited to upland game birds, Hungarian partridge, ring-necked pheasant, mourning dove, and songbirds. Populations of these birds can be increased by planting shrubs in fence lines and along roads and odd field corners. These plantings provide additional cover and nesting areas.

The hazard of flooding, a seasonal water table, the limited ability of these soils to support a load, and a high potential frost action are limitations for urban development. Homes or roads that are built on these soils must be designed to offset these limitations. Flooding, relatively slow permeability, and the seasonal high water table are concerns if these soils are used for septic tank absorption fields. Contamination of the ground water supply is also a hazard. Capability subclass IIw.

14-Chatcolet silt loam, 3 to 20 percent slopes. This undulating to hilly soil is very deep and moderately well drained. It is on glaciolacustrine terraces at elevations of 2,300 to 2,800 feet. It formed in a volcanic ash mantle over glaciolacustrine sediment. This soil supports a plant community of western hemlock-pachistima. The average annual precipitation is about 27 inches, including 5 to 8 feet of snow. Average annual air temperature is about 40 degrees F.

Included with this soil in mapping are small areas of Moctileme silt loam, Porrett silt loam, and Chatcolet soils with steeper slopes. This soil has moderately slow permeability. Effective rooting depth is more than 60 inches, and available water capacity is 11 to 13 inches. Surface runoff is rapid, and the hazard of erosion is high.

In a typical profile the surface layer is brown, neutral silt loam about 8 inches thick. The upper part of the subsoil is yellowish brown and pale brown, slightly acid and neutral silt loam about 16 inches thick. The lower part is pale brown, neutral silt loam and silty clay loam to a depth of 60 inches.

This soil is mainly used for woodland, hay, pasture, and urban and recreational homesites.

This soil is suited to the production of western hemlock, western redcedar, western white pine, grand fir, Douglas-fir, western larch, lodgepole pine, and ponderosa pine. It is capable of producing about 11,750 cubic feet per acre 0.6 inch and more in diameter or 50,500 board feet (Scribner rule) of merchantable timber 12.6 inches and more in diameter from an unmanaged stand of 80 year old trees. Wetness restricts conventional logging operations during rainy periods. Carefully managed reforestation after harvest reduces plant competition of the undesirable understory plants.

Various conservation practices are needed when the Chatcolet soil is used for hay and pasture. Fertilization is beneficial. Grasses respond readily to applications of nitrogen, and the legumes respond to phosphorus. Some areas need sulfur. Pasture and hayland management practices are needed, including rotation grazing, cross-fencing, and planting of adaptable grass-legume mixtures.

The Chatcolet soil has potential for grazing where the tree canopy is opened by fire or logging. Seeding disturbed areas of this soil to adapted grasses increases forage production. Important forage plants are elk sedge, willow, mountain maple, and red-stem ceanothus. Management of vegetation should be designed to protect timber regeneration and to insure adequate litter for soil protection.

This soil produces forage for livestock and big game animals for 5 to 10 years following opening of the canopy. During this period, the total annual production varies from more than 2,500 pounds of air-dry forage per acre to less than 200 pounds per acre as the canopy closes.

The Chatcolet soil has potential as woodland wildlife habitat for white-tailed deer, black bear, forest grouse, songbirds, chipmunks, and squirrels.

This soil is used for homesite development and recreational purposes. The moderately slow permeability, slope, potential frost action, and moderate shrink-swell potential of the subsoil are limitations for homesite development and roads. Drainage is needed along unsupported cut slopes to help prevent soil slippage in dwelling and road construction. Capability subclass VIe.

15-DeVoignes silt loam. This level soil is very deep and poorly drained. It is in basins of flood plains at elevations of 2,140 to 2,160 feet. It formed in alluvium and organic deposits. The average annual precipitation is about 22 inches. Average annual air temperature is about 44 degrees F.

Included with this soil in mapping are areas of Pywell muck and Miesen silt loam. These included soils have slopes of 0 to 1 percent.

This soil has slow permeability. Effective rooting depth is 60 inches or more, and available water capacity is 10 to 13 inches. Surface runoff is very slow, and the hazard of erosion is slight. A seasonal high water table is at a depth of 18 to 36 inches from April to July. Artificial drainage is necessary to farm this soil. Frequent flooding is a hazard from December to May unless the soil is protected by levees.

In a typical profile the surface layer is pale brown, very strongly acid silt loam about 9 inches thick. The upper 15 inches of the substratum is grayish brown and gray peat, thinly stratified with silt loam and silty clay loam. The lower part of the substratum, below a depth of 24 inches, is mottled, light brownish gray, very strongly acid silty clay loam. When the soil dries, wide cracks 1/2 inch to 2 inches wide develop from the surface to below a depth of 36 inches.

Small grain is generally the main spring crop because of wetness. Grass-hay and pasture are also suitable. Small grain, pasture, and hay need applications of fertilizers for good production. Grasses and small grain respond readily to nitrogen.

The potential vegetation on this soil is dominated by such water-tolerant plants as willows, cattails, sedges, and rushes. Under heavy grazing, the proportion of the sedges generally decreases, and willows, thistles, and quack grass invade and increase. This soil has potential as wetland wildlife habitat for water fowl. White-tailed deer, rodents, and forest grouse also use the vegetation on this soil.

This soil is poorly suited to building site development and sanitary facilities because of the hazard of flooding and the seasonal high water table. Slow permeability also influences septic tank absorption fields. When this soil is used for embankments, the low strength, excess humus, and instability of this soil must be considered. Capability subclass IVw.

16-Divers silt loam, 35 to 65 percent slopes. This very steep soil is very deep and well drained. It is on mountains at elevations of 4,200 to 6,000 feet. It formed in volcanic ash and colluvium and residuum derived from metasedimentary rock. This soil supports a plant community of subalpine fir-pachistima. The average annual precipitation is about 42 inches. Average annual air temperature is about 38 degrees F.

Included with this soil in mapping are areas of Huckleberry silt loam, 35 to 65 percent slopes.

This soil has moderate permeability. Effective rooting depth is more than 40 inches, and available water capacity is 4 or 5 inches. Surface runoff is very rapid, and the hazard of erosion is very high.

In a typical profile the surface layer is dark brown, medium acid silt loam about 4 inches thick. The subsoil is brown and light yellowish brown, medium acid to strongly acid silt loam, gravelly silt loam, and very stony silt loam about 20 inches thick. The substratum is light yellowish brown, very strongly acid very stony loam about 16 inches thick. Stones, cobbles, and gravel with some fines are at a depth of about 40 inches.

This soil is mainly used as woodland, watershed, and wildlife habitat. Some clear areas are used for limited grazing.

This soil is suited to the production of subalpine fir, western white pine, Engelmann spruce, grand fir, and western larch. It is capable of producing about 9,000 cubic feet per acre 0.6 inch and more in diameter or 17,900 board feet (Scribner rule) of merchantable timber 12.6 inches and more in diameter from an unmanaged stand of 80 year old trees. Very steep slopes and the very high hazard of erosion restrict the use of this soil for timber production. Logging roads are difficult to maintain because the roadbanks slide and slump. Trees can be harvested by special equipment and methods in logging that cause minimum soil disturbance.

This soil is well suited to woodland wildlife habitat for white-tailed deer, elk, black bear, small rodents, forest grouse, and various songbirds.

This soil has some value for grazing by domestic livestock where the timber stand has been opened by fire or by logging. Grazing needs to be limited to summer when the soils are dry and the forage plants have achieved almost full growth.

The main forage plants for livestock are Idaho fescue, bromegrass, and sedges. Grazing management should be designed to protect tree regeneration and to maintain adequate plant cover and litter for soil protection.

This Divers soil produces forage for livestock and big game animals for 15 to 20 years following opening of the canopy. During this period, the total annual production varies from 1,400 pounds per acre of air-dry forage to less than 200 pounds per acre as the canopy closes. Very steep slopes limit livestock movement and forage accessibility.

Very steep slopes limit homesites, roads, and recreational development. Extensive site preparation is a major deterrent to construction on this soil.

This soil should be managed to keep soil losses to a minimum, thus maintaining its watershed potential. The main concern in meeting this goal is the careful management of the timber resource and understory vegetation. Capability subclass VIIe.

17-Divers-Brickel association. This map unit consists of very steep soils on mountain side slopes and ridgetops at elevations of 4,200 to 6,155 feet. It is about 50 percent Divers silt loam, 45 to 75 percent slopes and 20 percent Brickel cobbly loam, 45 to 75 percent slopes. The Divers soil is at the lower elevations on mountain side slopes, and the Brickel soil is on the steep ridges at a higher elevation. Both soils support a subalpine fir-beargrass plant community.

Included with these soils in mapping are Divers silt loam, 5 to 45 percent slopes, Brickel silt loam, 5 to 45 percent slopes, and Rubble land. The included soils each make up 10 percent of the map unit.

The Divers soil is deep and well drained. It formed in material derived from metasedimentary rock with a mantle of volcanic ash. Permeability is moderate. Effective rooting - depth is more than 40 inches. Available water capacity is 4 or 5 inches. Surface runoff is very rapid, and the hazard of erosion is very high. The average annual air temperature is about 38 degrees F. Average annual precipitation is about 42 inches.

In a typical profile of the Divers soil the surface layer is dark brown, medium acid silt loam about 4 inches thick. The subsoil is brown and light yellowish brown, medium acid to strongly acid silt loam, gravelly silt loam, and very stony silt loam about 20 inches thick. The substratum is light yellowish brown, very strongly acid very stony loam about 16 inches thick. Stones, cobbles and gravel with some fines are at a depth of about 40 inches.

The Brickel soil is moderately deep and well drained. It formed in materials derived from granitic rock with a mantle of loess and volcanic ash. Permeability is moderate. Effective rooting depth is 20 to 40 inches, and available water capacity is 1 to 3 inches. Surface runoff is very rapid, and the hazard of erosion is very high. The average annual precipitation is about 40 inches, including about 10 feet of snow. Average annual air temperature is about 40 degrees F.

In a typical profile of the Brickel soil the surface layer is dark grayish brown, strongly acid cobbly loam about 3 inches thick. The subsoil is dark brown, strongly acid very cobbly loam about 5 inches thick. Weathered granitic bedrock is at a depth of about 24 inches.

The Divers soil is mainly used for woodland, limited grazing, recreation, watershed, and wildlife habitat.

The Divers soil is suited to the production of subalpine fir, Douglas-fir, western white pine, Engelmann spruce, grand fir, mountain hemlock, and western larch. It is capable of producing about 9,000 cubic feet per acre 0.6 inch and more in diameter or 17,900 board feet (Scribner rule) of merchantable timber 12.6 inches and more in diameter from an unmanaged stand of 80 year old trees. Very steep slopes and the very high hazard of erosion restrict the use of the Divers soil for timber production. Logging roads are difficult to maintain because the roadbanks tend to slide and slump. Trees can he harvested by special equipment and logging operations that cause minimum soil disturbance.

The Divers soil is suited to woodland wildlife habitat for white-tailed deer, elk, black bear, small rodents, forest grouse, and various songbirds. Road construction and homesite and recreational developments are severely limited by the very steep slopes.

The vegetation cover on the Brickel soil is very fragile. This soil is used for watershed. It is also used for recreation, some grazing, and woodland. The high elevations, short growing season, and the stones and cobbles on the soil limit vegetation growth.

The Brickel soil is suited to the production of subalpine fir and Engelmann spruce. It is capable of producing about 6,500 cubic feet per acre 0.6 inch and more in diameter or 2,300 board feet (Scribner rule) of merchantable timber 12.6 inches and more in diameter from an unmanaged stand of 80 year old trees. Very steep slopes, the very high hazard of erosion, windthrow hazard, and stones restrict the use of the Brickel soil for timber production. Logging roads are difficult to construct and maintain because of the depth to bedrock and the tendency of roadbanks to slump and slide. Trees can be harvested by special equipment and methods of logging that cause minimum soil disturbance.

The Brickel soil is suited to woodland wildlife habitat for white-tailed deer, elk, black bear, chipmunks, squirrels, and forest grouse. Very steep slopes and the depth to bedrock restrict the use of the Brickel soil for homesites. Roads must be built with low slope gradients to minimize soil losses and soil slumps on unprotected cutbanks. Steep slopes also restrict recreational uses of the Brickel soil.

Both soils have limited value for grazing by domestic livestock and large game animals when the canopy has been opened by fire or logging. Livestock grazing needs to be limited to summer when the soils are dry and the forage plants have achieved almost full growth.

The main native forage plants for livestock are Idaho fescue, bromegrass, and sedges. Grazing management should be designed to protect tree regeneration and to maintain adequate plant cover and litter for soil protection.

These soils produce forage for livestock and big game animals for 15 to 20 years following opening of the canopy. During this period, the total annual production varies from about 1,200 pounds per acre of air-dry forage to less than 150 pounds per acre as the canopy closes.

These soils should be managed to keep soil losses to a minimum, thus maintaining their watershed potential. The main concern in meeting this goal is careful management of existing vegetation. Both soils are in capability subclass VIIe, Brickel soil in capability subclass VIIs.

18-Dorb silt loam, 5 to 35 percent slopes. This soil is moderately deep and well drained. It is on basaltic plateaus and canyon walls at elevations of 3,125 to 3,200 feet. It formed in residuum and colluvium derived from basalt with a mantle of volcanic ash. This soil supports a western hemlock-pachistima plant community. The average annual precipitation is about 27 inches, including 5 to 8 feet of snow. Average annual air temperature is about 40 degrees F.

Included with this soil in mapping are small areas of Blinn stony loam, Lacy stony loam, Bobbitt stony loam, and Rock outcrop.

The soil has moderate permeability. Effective rooting depth is 20 to 40 inches, and available water capacity is about 3 inches. Surface runoff is rapid, and the hazard of erosion is high.

In a typical profile the surface layer is light gray silt loam about 1/2 inch thick. The upper 12 inches of the subsoil is yellowish brown, slightly acid silt loam, and the lower 14 inches is yellowish brown, neutral very cobbly silt loam. Basalt is at a depth of 26 inches.

Most areas of this soil are used as woodland. This soil is also used for limited livestock grazing, wildlife habitat, and recreation.

This soil is suited to the production of western hemlock, western redcedar, Douglas-fir, grand fir, western larch, and western white pine. It is capable of producing about 11,750 cubic feet per acre 0.6 inch and more in diameter or 50,500 board feet (Scribner rule) of merchantable timber 12.6 inches and more in diameter from an unmanaged stand of 80 year old trees. Excessive rock fragments in the soil and the high hazard of erosion restrict the use of this soil for timber production. Trees can be harvested by conventional methods, but logging roads, skid trails, and landings must be planned to minimize soil losses.

This soil has potential for grazing where the tree canopy is opened by logging or fire. Seeding disturbed areas of this soil to adapted grasses increases forage production. Important native forage plants are elk sedge, willow, mountain maple, and red-stem ceanothus. Management of vegetation should be designed to protect timber regeneration and to insure adequate litter for soil protection.

This soil produces forage for livestock and big game animals for 5 to 15 years following opening of the canopy. During this period, the total annual production varies from about 3,000 pounds of air-dry forage per acre to less than 300 pounds per acre as the canopy closes.

Some areas of this soil are used for recreation. Slopes and dust during dry periods are limitations for recreational development.

Areas of this soil provide woodland wildlife habitat for white-tailed deer, black bear, many songbirds, forest grouse, chipmunks, and squirrels.

Slopes and depth to bedrock are the main limitations for the construction of houses, roads, and sanitary facilities. The extensive site preparation needed is a major limitation to construction on this soil. Capability subclass VIe.

19-Dorb association. This map unit consists of sloping to very steep soils on basaltic plateaus, escarpments, and canyon walls at elevations of 2,125 to 3,200 feet. It is about 50 percent Dorb silt loam, 35 to 65 percent slopes, and 25 percent Dorb silt loam, 5 to 35 percent slopes. Both soils support a western hemlock-pachistima plant community.

Included with these soils in mapping are areas of Blinn stony loam, 35 to 65 percent slopes. Also included are small areas of Pokey silt loam, Porrett silt loam, and Potlatch silt loam that have slopes of 0 to 2 percent. These included soils make up about 25 percent of the map unit.

Dorb soils are moderately deep and well drained. They formed in residuum and colluvium derived from basalt with a mantle of volcanic ash. Permeability is moderate. Effective rooting depth is 20 to 40 inches, and available water capacity is about 3 inches. Surface runoff is very rapid, and the hazard of erosion is very high on the Dorb soil that has slopes of 35 to 65 percent. Surface runoff is rapid, and the hazard of erosion is high on the Dorb soil that has slopes of 5 to 35 percent. The average annual precipitation is about 27 inches, including 5 to 8 feet of snow. Average annual air temperature is about 40 degrees F.

In a typical profile the surface layer is light gray silt loam 1/2 inch thick. The upper 12 inches of the subsoil is yellowish brown, slightly acid silt loam, and the lower 14 inches is yellowish brown, neutral very cobbly silt loam. Fractured basalt bedrock is at a depth of about 26 inches.

Most areas of these Dorb soils are in woodland. Small areas of Dorb silt loam, 5 to 35 percent slopes, have been cleared and are used for pasture or hay. They are suited to the production of western hemlock, western redcedar, Douglas-fir, grand fir, western larch, and western -white pine. This soil is capable of producing about 11,750 cubic feet per acre 0.6 inch and more in diameter or 50,500 board feet (Scribner rule) of merchantable timber 12.6 inches and more in diameter from an unmanaged stand of 80 year old trees.

Steep and very steep slopes, excessive rock fragments in the soil, and the high or very high hazard of erosion restrict the use of these soils for timber production. Trees can be harvested on Dorb silt loam, 5 to 35 percent slopes, by conventional methods, but logging roads, skid trails, and landings need special planning to minimize soil losses. Special equipment and methods of logging that cause minimum soil disturbance are needed on Dorb silt loam, 35 to 65 percent slopes.

Areas of these soils provide woodland wildlife habitat for white-tailed deer, black bear, many songbirds, forest grouse, chipmunks, and squirrels.

These soils have limited potential for grazing where the tree canopy is opened by logging or fire. Seeding disturbed areas of these soils to grass increases ground cover and helps protect the soil. Important forage plants are seeded grasses, elk sedge, willow, mountain maple, and red-stem ceanothus. Management of vegetation should be designed to protect timber regeneration and to insure adequate litter for soil protection.

These soils produce forage for livestock and big game animals for 5 to 15 years following opening of the canopy. During this period, the total annual production varies from about 3,000 pounds of air-dry forage per acre to less than 300 pounds per acre as the canopy closes. The slope of Dorb silt loam, 35 to 65 percent slopes, severely limits livestock movement and the accessibility of the forage. Steep and very steep slopes and the depth to bedrock are limitations for construction of homes, roads, and sanitary facilities. The extensive site preparation needed is a major limitation to construction on these soils, especially where slopes are 35 to 65 percent. Dorb silt loam, 5 to 35 percent slopes in capability subclass VIe; Dorb silt loam, 35 to 65 percent slopes in capability subclass VIIe.

20-Garfield-Tilma complex, 3 to 40 percent slopes. These gently sloping to steep soils are on the loess hills at elevations of 2,125 to 3,200 feet. The average annual precipitation is about 20 inches and the frost-free season is 110 to 140 clays. Average annual air temperature is about 48 degrees F. This map unit is about 45 percent Garfield silty clay loam, 3 to 40 percent slopes, and 35 percent Tilma silt loam, 3 to 25 percent slopes. The Garfield soil is on the steeper, convex parts of the landscape, and the Tilma soil is on-the less steep, concave positions along drainageways.

Included with these soils in mapping are areas of Naff silt loam and Thatuna silt loam and some severely eroded areas of Garfield silty clay loam. The included soils make up 20 percent of this map unit.

The Garfield soil is very deep and well drained. It formed in loess. Permeability is slow. Effective rooting depth is 60 inches, and available water capacity is 11 to 13 inches. Surface runoff is very rapid, and the hazard of erosion is very high.

In a typical profile of the Garfield soil the surface layer is brown, medium acid silty clay loam about 7 inches thick. The subsoil is light brown, brown, and light yellowish brown, slightly acid to mildly alkaline silty clay and silty clay loam to a depth of about 60 inches.

The Tilma soil is very deep and moderately well drained. It formed in deep loess. Permeability is slow. Effective rooting depth is 60 inches, and available water capacity is 10 to 12 inches. Surface runoff is very rapid, and the hazard of erosion is very high.

In a typical profile of the Tilma soil the surface layer is dark grayish brown, medium acid and slightly acid silt loam 14 inches thick. The subsoil is grayish brown, slightly acid silt loam about 6 inches thick. The buried subsurface layer is pale brown and light gray, slightly acid silt loam about 4 inches thick. The buried subsoil is brown and light yellowish brown, medium acid and slightly acid mainly silty clay and silty clay loam to a depth of 60 inches.

Most areas of these soils are in cultivated crops. Annual small grain, peas, lentils, and grass seed are the main crops. A crop rotation that includes grass and legumes at least 2 years in 8 is needed to minimize soil losses. Hilltop and steep slope planting of grass is a practical method of erosion control.

No single crop rotation is currently used on the soils of this unit. A common crop sequence includes seeding winter wheat or barley in fall or peas or lentils in spring. Wheat or barley is occasionally spring seeded. Grasses for seed are grown in some areas. During the grain crop period of a rotation, tillage must be practiced, and all crop residue must be utilized. Any tillage method that prevents the soil from moving down hill is needed. In any crop system on these soils a fertilization program that includes phosphorus, nitrogen, and sulfur is essential for maintaining production.

These soils have potential as openland and rangeland wildlife habitats. Upland game birds, ring-necked pheasant, and Hungarian partridge generally are suited to these soils because adequate cover and food are available.

When planning homesites on these soils, the soil properties that affect sanitary facilities and the construction of buildings or roads need to be considered. The Tilma soil has a perched water table during winter and spring that limits septic tank absorption fields. Both soils have steep and very steep slopes, slow permeability, and high shrink-swell potential. These limitations need to be considered when planning the construction of buildings and roads. Capability subclass IVe.

21-Helmer silt loam, 3 to 20 percent slopes. This soil is very deep and moderately well drained. It is on loess hills at elevations of 2,700 to 4,500 feet. It formed in thick loess deposits with a mixture of volcanic ash. This soil supports a western redcedar-pachistima plant community. The average annual precipitation is about 35 inches. Average annual air temperature is about 42 degrees F.

Included with this soil in mapping are areas of Huckleberry silt loam and Santa silt loam. These soils have slopes of 3 to 20 percent.

This soil has very slow permeability. Effective rooting depth is more than 60 inches, and available water capacity is about 8 inches. Surface runoff is rapid, and the hazard of erosion is high. A perched temporary water table is at a depth of 2 to 2.5 feet from April to February.

In a typical profile the surface layer is covered by about 2.5 inches of needles, leaves, and twigs in various stages of decomposition. The subsoil is light yellowish brown, strongly acid to slightly acid silt loam about 19 inches thick. The buried subsurface layer is light yellowish brown and pale brown, very strongly acid, brittle silt loam about 23 inches thick. The buried subsoil is light yellowish brown, extremely acid, brittle silt loam to a depth of about 60 inches.

This soil generally is not suited to cultivated crops because of the hazard of erosion. It is used for pasture, woodland, and wildlife habitat.

This soil is suited to the production of western redcedar, grand fir, western white pine, western larch, Douglas-fir, and lodgepole pine. It is capable of producing about 11,750 cubic feet per acre 0.6 inch and more in diameter or 50,500 board feet (Scribner rule) of merchantable timber 12.6 inches and more in diameter from an unmanaged stand of 80 year old trees. The high hazard of erosion restricts the use of this soil for timber production. Trees can be harvested by conventional methods, but logging roads, skid trails, and landings need special planning to minimize soil losses.

This soil has potential for grazing where the tree canopy is opened by logging or fire. Seeding disturbed areas of this soil to adapted grasses increases forage production. Important native forage plants are elk sedge, willow, mountain maple, and red-stem ceanothus. Management of vegetation should be designed to protect timber regeneration and to insure adequate litter for soil protection.

The Helmer soil produces forage for livestock and big game animals for 10 to 15 years following opening of the canopy. During this period, the total annual production varies from about 2,400 pounds of air-dry forage per acre to less than 150 pounds per acre as the canopy closes.

This soil has potential as woodland wildlife habitat for white-tailed deer, black bear, chipmunks, squirrels, forest grouse, and songbirds.

A perched water table during the rainy season and a high potential frost action, are limitations for sanitary facilities and homesites. Dwellings and road construction can be designed to offset these limitations. Drainage is needed along unsupported cut slopes to prevent soil slippage. Community sewage systems must be anticipated in areas of moderate to high density population because septic tank absorption fields will not function properly during the rainy periods because of the very slow permeability and a perched water table. Capability subclass VIe.

22-Helmer silt loam, 20 to 10 percent slopes. This soil is very deep and moderately well drained- It is on loess hills at elevations of 2,700 to 4,500 feet. It formed in thick loess deposits with a mixture of volcanic ash. This soil supports a western redcedar-pachistima plant community. The average annual precipitation is about 35 inches, and the average frost-free period is about 70 to 110 days. Average annual air temperature is about 42 degrees F.

Included with this soil in mapping are areas of Dorb silt loam, Nakarna silt loam, and Huckleberry silt loam. These included soils have slopes of 35 to 65 percent.

This soil has very slow permeability. Effective rooting depth is more than 60 inches, and available water capacity is about 8 inches. Surface runoff is very rapid, and the hazard of erosion is very high.

In a typical profile the surface is covered by about 2.5 inches of needles, leaves, and twigs in various stages of decomposition. The subsoil is light yellowish brown, strongly acid to slightly acid silt loam about 19 inches thick. The buried subsurface layer is pale brown and light yellowish brown, very strongly acid, brittle silt loam about 23 inches thick. Below this is light yellowish brown, extremely acid silt loam to a depth of about 60 inches.

This soil is used for timber production, recreation, wildlife habitat, and watershed.

This soil is suited to the production of western redcedar, Douglas-fir, grand fir, western larch, lodgepole pine, and western white pine. It is capable of producing about 11,750 cubic feet per acre 0.6 inch and more in diameter of 50,500 board feet (Scribner rule) of merchantable timber 12.6 inches and more in diameter from an unmanaged stand of 80 year old trees. Steep slopes and the very high hazard of erosion restrict the use of this soil for timber production. The very high hazard of erosion and the steep slopes cause difficulty in constructing and maintaining logging roads. Exposing large areas of soil and logging during the rainy winter and spring months need to be avoided. Special equipment and methods of logging are needed to reduce soil losses.

The Helmer soil has some potential for grazing where the tree canopy is opened by logging or fire. Seeding disturbed areas of this soil to adapted grasses increases forage production and helps protect the soil. The slope limits livestock movement and the accessibility of forage. Important forage plants are seeded grasses, elk sedge, willow, mountain maple, and red-stem ceanothus. Management of vegetation should be designed to protect timber regeneration and to insure adequate litter for soil protection.

This soil produces forage for livestock and big game animals for 10 to 15 years following opening of the canopy. During this period, the total annual production varies from about 2,400 pounds of air-dry forage per acre to less than 150 pounds per acre as the canopy closes.

This soil has potential as woodland wildlife habitat for white-tailed deer, black bear, squirrels, forest grouse, and songbirds.

The perched water table late in winter and early in spring, a high potential frost action for roads and dwellings, and the steep slopes are limitations for sanitary facilities and homesite development. Footings need to be placed below frost line. Drainage is needed along unsupported cut slopes as a protective measure to prevent soil slippage. Capability subclass VIe.

23-Huckleberry silt loam, 5 to 20 percent slopes. This rolling to hilly soil is moderately deep and well drained. It is on mountain side slopes at elevations of 3,300 to 6,000 feet. It formed in a loess and volcanic ash mantle over residuum derived from sedimentary rock. This soil supports a western redcedar-pachistima plant community. The average annual precipitation is about 35 inches. Average annual air temperature is about 41 degrees F.

Included with this soil in mapping are Huckleberry and Ardenvoir soils that have slopes of 20 to 35 percent. Also included are small areas of Helmer silt loam, 5 to 20 percent slopes and Porrett silt loam, 0 to 2 percent slopes.

This soil has moderate permeability. Effective rooting depth is 20 to 40 inches, and available water capacity is 5 to 6 inches. Surface runoff is rapid, and the hazard of erosion is high.

In a typical profile the surface is covered by 2.5 inches of coniferous needles and twigs. The upper 16 inches of the subsoil is yellowish brown and light yellowish brown, medium acid silt loam, and the lower 10 inches is pale brown, medium acid gravelly silt loam. The substratum is very pale brown, medium acid very gravelly loam about 10 inches thick. Weathered shale is at a depth of about 36 inches.

This soil is not suited to cultivated crops. It is used for timber production, wildlife habitat, watershed, and limited grazing in cleared areas.

This soil is suited to the production of western redcedar, Douglas-fir, grand fir, western larch, and western white pine. It is capable of producing about 10,350 cubic feet per acre 0.6 inch and more in diameter of 34,600 board feet (Scribner rule) of merchantable timber 12.6 inches and more in diameter from an unmanaged stand of 80 year old trees. The high hazard of erosion restricts the use of this soil for timber production. Trees can be harvested by conventional methods, but landings, logging roads, and skid trails require special planning to minimize soil losses.

This soil has potential for grazing where the tree canopy is opened by logging or fire. Seeding disturbed areas of this soil to adapted grasses increases forage production. Important forage plants are seeded grasses, bromegrass, elk sedge, willow, mountain maple, and redstem ceanothus. Management of vegetation should be designed to protect timber regeneration and to insure adequate litter for soil protection.

This soil produces forage for livestock and big game animals for 10 to 15 years following opening of the canopy. During this period, the total annual production varies from about 2,200 pounds of air-dry forage per acre to less than 150 pounds per acre as the canopy closes.

This Huckleberry soil has potential as woodland wildlife habitat for deer, elk, black bear, squirrels, chipmunks, forest grouse, and various songbirds. The depth to bedrock and potential frost action are the main limitations in the construction of dwellings and roads. Capability subclass VIe.

24-Huckleberry silt loam, 20 to 35 percent slopes. This steep soil is moderately deep and well drained. It is on mountain side slopes at elevations of 3,300 to 6,000 feet. It formed in a loess and volcanic ash mantle over residuum derived from sedimentary rock. This soil supports a western redeedar-pachistima plant community. The average annual precipitation is about 35 inches. Average annual air temperature is about 41 degrees F.

Included with this soil in mapping are Huckleberry and Ardenvoir soils that have slopes of 35 to 65 percent and small areas of Helmer silt loam, 20 to 35 percent slopes, and Porrett silt loam, 0 to 2 percent slopes.

This soil has moderate permeability. Effective rooting depth is 20 to 40 inches, and available water capacity is 5 to 6 inches. Surface runoff is very rapid, and the hazard of erosion is very high.

In a typical profile the surface is covered by 2.5 inches of coniferous needles and twigs. The upper 16 inches of the subsoil is yellowish brown and light yellowish brown, medium acid silt loam, and the lower 10 inches is pale brown, medium acid gravelly silt loam. The substratum is very pale brown, medium acid very gravelly loam about 10 inches thick. Weathered shale is at a depth of about 36 inches.

This soil is used for timber production, wildlife habitat, watershed and limited grazing in cleared areas.

This Huckleberry soil is suited to the production of western white pine, western redcedar, Douglas-fir, grand fir, and western larch. It is capable of producing about 10,350 cubic feet per acre 0.6 inch and more in diameter or 34,600 board feet (Scribner rule) of merchantable timber 12.6 inches and more in diameter from an unmanaged stand of 80 year old trees. Steep slopes and the very high hazard of erosion restrict the use of this soil for timber production. Trees can be harvested by conventional methods, but landings, logging roads, and skid trails require careful planning to minimize soil losses.

The Huckleberry soil has limited potential for grazing where the tree canopy is opened by logging or fire. Seeding disturbed areas of this soil to adapted grasses increases forage production and helps protect the soil. Important forage plants are seeded grasses, bromegrass, elk sedge, willow, mountain maple, and red-stem ceanothus. Management of vegetation should be designed to protect timber regeneration and to insure adequate litter for soil protection.

This soil produces forage for livestock and big game animals for 10 to 15 years following opening of the canopy. During this period, the total annual production varies from about 2,000 pounds of air-dry forage per acre to less than 150 pounds per acre as the canopy closes.

This Huckleberry soil has potential as woodland wildlife habitat for white-tailed deer, elk, black bear, squirrels, chipmunks, forest grouse, and various songbirds.

The slope and depth to bedrock are the main limitations in the construction of dwellings and roads. Capability subclass VIe.

25-Huckleberry silt loam, 35 to 65 percent slopes. This very steep soil is moderately deep and well drained. It is on mountain side slopes at elevations of 3,300 to 6,000 feet. It formed in a loess and volcanic ash mantle over residuum derived from sedimentary rock. This soil supports a western redcedar-pachistima plant community. The average annual precipitation is about 35 inches. Average annual air temperature is about 41 degrees F.

Included with this soil in mapping are areas of Ardenvoir gravelly loam and small areas of Helmer silt loam, 20 to 40 percent slopes, and Porrett silt loam, 0 to 2 percent slopes.

This soil has moderate permeability. Effective rooting depth is 20 to 40 inches, and available water capacity is 5 to 6 inches. Surface runoff is very rapid, and the hazard of erosion is very high.

In a typical profile the surface is covered by 2.5 inches of coniferous needles and twigs. The upper 16 inches of the subsoil is yellowish brown and light yellowish brown, medium acid silt loam, and the lower 10 inches is pale brown, medium acid gravelly silt loam. The substratum is very pale brown, medium acid very gravelly loam about 10 inches thick. Weathered shale is at a depth of about 36 inches.

This soil is mainly used for timber production, wildlife habitat, watershed, and limited grazing in cleared areas.

This Huckleberry soil is suited to the production of western redcedar, Douglas-fir, grand fir, western larch, and western white pine. It is capable of producing about 10,350 cubic feet per acre 0.6 inch and more in diameter or 34,600 board feet (Scribner rule) of merchantable timber 12.6 inches and more in diameter from an unmanaged stand of 80 year old trees. Very steep slopes and the very high hazard of erosion restrict the use of this soil for timber production. Special equipment and methods of logging are needed to minimize soil losses.

This soil has some potential for grazing where the tree canopy is opened by logging or fire. Seeding disturbed areas of this soil to adapted grasses increases vegetation cover and helps protect the soil. Important forage plants are seeded grasses, bromegrass, elk sedge, willow, mountain maple, and red-stem ceanothus. Management of vegetation should be designed to protect timber regeneration, provide good vegetation cover, and insure adequate litter for soil protection.

This soil produces forage for livestock and big game animals for 10 to 15 years following opening of the canopy. During this period, the total annual production varies from about 2,000 pounds of air-dry forage per acre to less than 150 pounds per acre as the canopy closes. Very steep slopes severely limit livestock movement and accessibility of the forage.

This Huckleberry soil has potential as woodland wildlife habitat for white-tailed deer, elk, black bear, squirrels, chipmunks, forest grouse, and various songbirds.

The slope and depth to rock are limitations in the construction of dwellings and roads. Capability subclass VIIe.

26-Huckleberry-Ardenvoir association, steep. This map unit consists of steep soils on mountain side slopes at elevations between about 3,300 and 6,000 feet. It is about 60 percent Huckleberry silt loam, 20 to 35 percent slopes, and 35 percent Ardenvoir gravelly loam, 20 to 35 percent slopes. The Huckleberry soil has northerly exposures, is in swales, and is moist longer. It supports a western redcedar-pachistima plant community. The Ardenvoir soil has southerly exposures, is on ridgetops, and dries out faster. It supports a grand fir-pachistima plant community.

Included with these soils in mapping is McCrosket very gravelly silt loam. This included soil makes up about 5 percent of the map unit.

The Huckleberry soil is moderately deep and well drained over weathered shale. It formed in a loess and volcanic ash mantle over residuum derived from sedimentary rock. Permeability is moderate. Effective rooting depth is 20 to 40 inches, and available water capacity is 5 or 6 inches. Surface runoff is very rapid, and the hazard of erosion is very high. The average annual precipitation is about 35 inches. Average annual air temperature is about 41 degrees F.

In a typical profile of the Huckleberry soil the surface is covered by 2.5 inches of coniferous needles and twigs. The upper 16 inches of the subsoil is yellowish brown and light yellowish brown, medium acid silt loam, and the lower 10 inches is pale brown, medium acid gravelly silt loam. The substratum is very pale brown, medium acid very gravelly loam about 10 inches thick. Weathered shale is at a depth of about 36 inches.

The Ardenvoir soil is deep and well drained over weathered metasedimentary bedrock. It formed in residuum derived from metasedimentary rock with a mantle of loess and volcanic ash. Permeability is moderate. Effective rooting depth is 40 to 60 inches, and available water capacity is 4 to 6 inches. Surface runoff is very rapid, and the hazard of erosion is very high. The average annual precipitation is about 29 inches, including 5 to 10 feet of snow. Average annual air temperature is about 42 degrees F.

In a typical profile of the Ardenvoir soil the surface layer is brown and light yellowish brown, neutral and slightly acid gravelly loam about 9 inches thick. The subsoil is very pale brown, slightly acid gravelly loam about 8 inches thick. The substratum is very pale brown, medium acid very cobbly loam and very flaggy loam about 29 inches thick. Weathered metasedimentary bedrock is at a depth of about 46 inches.

Livestock grazing is limited. Most areas of these soils are in woodland and used for timber production, watershed, and wildlife habitat.

The Huckleberry soil is suited to the production of western redcedar, Douglas-fir, grand fir, western larch, and western white pine. It is capable of producing about 10,350 cubic feet per acre 0.6 inch and more in diameter or 34,600 board feet (Scribner rule) of merchantable timber 12.6 inches and more in diameter from an unmanaged stand of 80 year old trees. Steep slopes and the very high hazard of erosion restrict the use of the Huckleberry soil for timber production. Trees can be harvested by conventional methods, but landings, logging roads, and skid trails require careful planning to minimize soil losses.

The Huckleberry soil has potential for grazing where the tree canopy is opened by logging or fire. Seeding disturbed areas of this soil to grasses increases forage production. Important forage plants are seeded grasses, elk sedge, willow, mountain maple, and red-stem ceanothus. Management of vegetation should be designed to protect timber regeneration and to insure adequate litter for soil protection.

The Huckleberry soil produces forage for livestock and big game animals for 10 to 15 years following opening of the canopy. During this period, the total annual production varies from about 2,200 pounds of air-dry forage per acre to less than 150 pounds per acre as the canopy closes.

The Ardenvoir soil is suited to the production of grand fir, Douglas-fir, and western larch. It is capable of producing about 5,900 cubic feet per acre 0.6 inch and more in diameter or 18,500 board feet (Scribner rule) of merchantable timber 11.6 inches and more in diameter from an unmanaged stand of 80 year old trees. Steep slopes and the very high hazard of erosion restrict the use of the Ardenvoir soil for timber production. Trees can be harvested by conventional methods, but landings, logging roads, and skid trails require careful planning to minimize soil losses. Carefully managed reforestation after harvest reduces plant competition of undesirable understory plants.

The Ardenvoir soil has potential for grazing where the tree canopy is opened by logging, fire, or some other disturbance. Seeding disturbed areas of this soil to adapted grasses increases forage production and helps protect the soil. Important forage plants are seeded grasses, elk sedge, mountain maple, and red-stem ceanothus. Creambush oceanspray and mallow ninebark, two relatively unpalatable shrubs, tend to dominate the vegetation once the canopy is opened. Management of vegetation should be designed to protect timber regeneration and to insure adequate litter for soil protection.

The Ardenvoir soil produces forage for livestock and big game animals for 20 to 30 years following opening of the canopy. During this period, the total annual production varies from about 1,800 pounds of air-dry forage per acre to less than 200 pounds per acre as the canopy closes.

The soils in this unit have potential as woodland wildlife habitat for white-tailed deer, elk, black bear, chipmunks, squirrels, and forest grouse.

The steep slopes and depth to bedrock are limitations in the construction of dwellings and roads.

Steep slopes and dust are limitations for such recreational development as trails and camp areas. Both soils in capability subclass VIe.

27-Huckleberry-Ardenvoir association, very steep. This map unit consists of very steep soils on mountain side slopes at elevations between about 3,300 and 6,000 feet. It is about 60 percent Huckleberry silt loam, 35 to 65 percent slopes, and 35 percent Ardenvoir gravelly loam, 35 to 65 percent slopes. The Huckleberry soil has northerly exposures, is in swales, and is moist longer. It supports a western redcedar-pachistima plant community. The Ardenvoir soil has southerly exposures, is on ridgetops, and dries out faster. It supports a grand fir-pachistima plant community.

Included with these soils in mapping is McCrosket gravelly silt loam. This included soil makes up about 5 percent of the map unit.

The Huckleberry soil is moderately deep and well drained over weathered shale. It formed in a loess and volcanic ash mantle over residuum derived from sedimentary rock. Permeability is moderate. Effective rooting depth is 20 to 40 inches, and available water capacity is 5 to 6 inches. Surface runoff is very rapid, and the hazard of erosion is very high. The average annual precipitation is about 35 inches. Average annual air temperature is about 41 degrees F.

In a typical profile of the Huckleberry soil the surface is covered by 2.5 inches of coniferous needles and twigs. The upper 16 inches of the subsoil is yellowish brown and light yellowish brown, medium acid silt loam, and the lower 10 inches is pale brown, medium acid gravelly silt loam. The substratum is very pale brown, medium acid very gravelly loam about 10 inches thick. Weathered shale is at a depth of about 36 inches.

The Ardenvoir soil is deep and well drained over weathered metasedimentary bedrock. It formed in residuum derived from metasedimentary rock with a mantle of loess and volcanic ash. Permeability is moderate. Effective rooting depth is 40 to 60 inches, and available water capacity is 4 to 6 inches. Surface runoff is very rapid, and the hazard of erosion is very high. The average annual precipitation is about 29 inches, including 5 to 10 feet of snow. Average annual air temperature is about 42 degrees F.

In a typical profile of the Ardenvoir soil the surface layer is brown and light yellowish brown, neutral and slightly acid gravelly loam about 9 inches thick. The subsoil is very pale brown, slightly acid gravelly loam about 8 inches thick. The substratum is very pale brown, medium acid very cobbly loam and very flaggy loam about 29 inches thick. Weathered metasedimentary bedrock is at a depth of about 46 inches.

The Huckleberry soil is suited to the production of western redcedar, Douglas-fir, grand fir, western larch, and western white pine. It is capable of producing about 10,350 cubic feet per acre 0.6 inch and more in diameter or 34,600 board feet (Scribner rule) of merchantable timber 12.6 inches and more in diameter from an unmanaged stand of 80 year old trees.

Very steep slopes and the very high hazard of erosion restrict the use of the Huckleberry soil for timber production. Specialized equipment and logging operations are necessary to minimize soil losses. The exposure of large areas of soil and logging during the rainy winter and spring needs to be avoided.

The Huckleberry soil has potential for grazing where the tree canopy is opened by logging or fire. Seeding disturbed areas of this soil to adapted grasses increases ground cover and helps protect the soil. Important forage plants on this soil are seeded grasses, elk sedge, willow, mountain maple, and red-stem ceanothus. Management of vegetation should be designed to protect timber regeneration and to insure adequate litter for soil protection.

The Huckleberry soil produces forage for livestock and big game for 10 to 15 years following opening of the canopy. During this period, annual production varies from about 2,200 pounds of air-dry forage per acre to less than 150 pounds per acre as the canopy closes. Very steep slopes severely limit livestock movement and the accessibility of the forage.

The Ardenvoir soil is suited to the production of Douglas-fir, grand fir, and western larch. It is capable of producing about 5,900 cubic feet per acre 0.6 inch and more in diameter or 18,500 board feet (Scribner rule) of merchantable timber 11.6 inches and more in diameter from an unmanaged stand of 80 year old trees. Very steep slopes and the very high hazard of erosion restrict the use of the Ardenvoir soil for timber production. Special equipment and methods of logging are needed to keep soil losses to a minimum. Carefully managed reforestation after harvest reduces plant competition of undesirable understory plants.

The Ardenvoir soil has some potential for grazing where the tree canopy is opened by logging, fire, or some other disturbance. Seeding disturbed areas of this soil to adapted grasses increases vegetation cover and helps protect the soil. Important forage plants are seeded grasses, elk sedge, mountain maple, and red-stem ceanothus. Creambush oceanspray and mallow ninebark, two relatively unpalatable shrubs, tend to dominate the vegetation once the canopy is opened. Management of vegetation should be designed to protect timber regeneration, to provide good vegetation cover, and to insure adequate litter for soil protection.

This soil produces forage for livestock and big game animals for 20 to 30 years following opening of the canopy. During this period, the total annual production varies from about 1,600 pounds of air-dry forage per acre to less than 200 pounds per acre as the canopy closes. The slope severely limits livestock movement and accessibility of forage.

The soils in this map unit have potential as woodland wildlife habitat for white-tailed deer, elk, black bear, chipmunks, squirrels, and forest grouse.

Very steep slopes and depth to bedrock are the main limitations in the construction of dwellings and roads.

Slope and dust are the main limitations for such recreational development as trails and camp areas. Both soils in capability subclass Vile.

28-Jacot-Garveson association. This map unit consists of very steep soils on mountain side slopes at elevations of 2,300 to 3,200 feet. It is about 40 percent Jacot coarse sandy loam, 35 to 65 percent slopes, and 40 percent Garveson loam, 35 to 65 percent slopes. The Jacot soil is on ridges and has southerly exposures. The Garveson soil has northerly exposures. These soils support a western hemlock-pachistima plant community.

Included with these soils in mapping are areas of Pokey fine sandy loam, 0 to 2 percent slopes. Also included are small areas of Dorb silt loam, 35 to 65 percent slopes, and Helmer silt loam, 20 to 40 percent slopes. The included soils make up about 20 percent of the map unit.

The Jacot soil is very deep and well drained. It formed in a mantle of volcanic ash over residuum weathered from granitic bedrock. Permeability is moderately rapid. Effective rooting depth is 60 inches, and available water capacity is about 6 or 7 inches. Surface runoff is very rapid, and the hazard of erosion is very high. The average annual precipitation is about 35 inches, including 3 to 5 feet of snow. Average annual air temperature is about 38 degrees F.

In a typical profile of the Jacot soil the surface is covered by 2.5 inches of needles, twigs, and leaves. The upper 20 inches of the subsoil is brown and light yellowish brown, slightly acid coarse sandy loam and sandy loam. It is over 23 inches of buried subsoil that is light yellowish brown and very pale brown, medium acid coarse sandy loam. The substratum is pale yellow, strongly acid very gravelly sandy loam to a depth of about 60 inches.

The Garveson soil is very deep and well drained. It formed in a volcanic ash mantle over material weathered from granitic rock. Permeability is moderate. Effective rooting depth is about 60 inches, and available water capacity is 4 to 6 inches. Surface runoff is very rapid, and the hazard of erosion is very high. The average annual precipitation is about 35 inches, including 3 to 5 feet of snow. Average annual air temperature is about 38 degrees F.

In a typical profile of the Garveson soil the surface is covered by 2 inches of needles, twigs, and leaves. The subsoil is very pale brown, medium acid loam and fine gravelly silt loam about 21 inches thick. The substratum is variegated very gravelly coarse sand to a depth of about 60 inches. Undisturbed areas have a layer of recent volcanic ash that is 1/4 to 1 inch thick.

The soils in this map unit are used mainly for woodland, and cut over areas are used for limited grazing.

These Jacot and Garveson soils are suited to the production of western hemlock, western redcedar, western white pine, grand fir, Douglas-fir, lodgepole pine, and western larch. The Jacot soil is capable of producing about 11,750 cubic feet per acre 0.6 inch and more in diameter or 50,500 board feet (Scribner rule) of merchantable timber 12.6 inches and more in diameter from an unmanaged stand of 80 year old trees. The Garveson soil is capable of producing about 10,350 cubic feet per acre 0.6 inch and more in diameter or 34,600 board feet (Scribner rule) of merchantable timber 12.6 inches and more in diameter in an unmanaged stand of 80 year old trees.

Very steep slopes and the very high hazard of erosion restrict the use of these soils for timber production. Conventional logging operations are limited. Special equipment and methods of logging that cause minimum soil disturbance are needed. Logging roads, skid trails, and landings must be carefully planned to minimize soil losses.

The Jacot and Garveson soils have limited potential for grazing where the tree canopy is opened by logging, fire, or some other disturbance. Seeding disturbed areas of these soils to adapted grasses increases vegetation cover and helps protect the soil. Important forage plants are seeded grasses, elk sedge, willow, rose, mountain maple, and red-stem ceanothus.. Management of vegetation should be designed to protect timber regeneration, to provide good plant cover, and to insure adequate litter for soil protection

The Jacot and Garveson soils produce forage for livestock and big game animals for 10 to 15 years following opening of the canopy. During this period, the total annual production varies from about 2,100 pounds of air-dry forage per acre to less than 300 pounds per acre as the canopy closes. Very steep slopes limit livestock movement and accessibility of forage.

The soils in this map unit must be managed to keep soil losses to a minimum, thus maintaining their watershed potential. The main concern is the careful management of the timber resource and understory vegetation.

Both soils have potential as woodland wildlife habitat for white-tailed deer, black bear, forest grouse, songbirds, squirrels, and chipmunks. Both soils in capability subclass VIIe.

29-Lacy-Bobbitt stony loams, 5 to 35 percent slopes. These rolling to steep soils are on mountain side slopes and terrace escarpments at elevations of 2,125 to 3,000 feet. The average annual precipitation is about 25 inches. Average annual air temperature is about 48 degrees F. This map unit is about 60 percent Lacy stony loam, and 30 percent Bobbit stony loam. Both have slopes of 5 to 35 percent slopes. These soils are so intricately mixed that they are not shown separately on the soil map. The Lacy soil supports a ponderosa pine-Idaho fescue plant community, and the Bobbitt soil supports a Douglas -fir-snowberry plant community.

Included with these soils in mapping are' areas of Blinn, Larkin, and Taney soils and Rock coutcrop. These included soils make up about 10 percent of the map unit.

The Lacy soil is shallow, well drained, and stony. It formed in residuum and colluvium derived from basalt with a small mantle of loess. Permeability is moderate. Effective rooting depth is 10 to 20 inches, and available water capacity is 1 to 2 inches. Surface runoff is rapid, and the hazard of erosion is high.

In a typical profile of the Lacy soil the surface layer is brown, neutral stony loam about 4 inches thick. The subsoil is dark brown, slightly acid and medium acid stony clay loam and very stony clay loam about 10 inches thick. Fractured basalt is at a depth of about 14 inches.

The Bobbitt soil is moderately deep, well drained, and stony. It formed in residuum and colluvium derived from basalt with a thin mantle of loess and volcanic ash. Permeability is moderate. Effective rooting depth is 20 to 40 inches, and available water capacity is 2 or 3 inches. Surface runoff is rapid, and the hazard of erosion is high.

In a typical profile of the Bobbitt soil the surface layer is brown, neutral stony loam about 4 inches thick. The subsoil is brown, neutral very stony clay loam about 17 inches thick. Fractured basalt is at a depth of about 21 inches.

The soils in this map unit are used for woodland, wildlife habitat, recreation, and grazing.

The Lacy soil is suited to the production of ponderosa pine. It is capable of producing about 3,400 cubic feet per acre 0.6 inch and more in diameter or 3,500 board feet (Scribner rule) of merchantable timber 11.6 inches and more in diameter from an unmanaged stand of 80 year old trees.

The Bobbitt soil is suited to the production of Douglas-fir and ponderosa pine. It is capable of producing about 5,900 cubic feet per acre 0.6 inch and more in diameter or 18,500 board feet (Scribner rule) of merchantable timber 11.6 inches and more in diameter from an unmanaged stand of 80 year old trees.

Stones and the depth to bedrock restrict the use of these Lacy and Bobbitt soils for timber production. Trees can be harvested by conventional methods, but road construction is difficult because of the depth to bedrock and the high hazard of erosion.

The soils in this map unit have potential for grazing especially where the tree canopy is opened up by logging or fire. Seeding disturbed areas of these soils to adapted grasses increases forage production. Important forage plants are seeded grasses, Idaho fescue, bluebunch wheatgrass, arrowleaf balsamroot, and geranium. Shrubs can dominate the vegetation on the Bobbitt soil once the canopy is opened. Management of vegetation should be designed to protect timber regeneration and to increase production of Idaho fescue and bluebunch wheatgrass.

These soils produce forage for livestock and big game animals continually under woodland management. The total annual production on the Lacy soil varies from 1,600 pounds of air-dry forage per acre to less than 100 pounds per acre as the canopy closes. The total annual production on the Bobbitt soil varies from 2,000 pounds of air-dry forage to less than 200 pounds per acre as the canopy closes. The type of grazing management is also important in the forage production on Lacy soils.

These soils have potential as woodland wildlife habitat for small animals such as chipmunks, squirrels, and various game birds and songbirds. Some white-tailed deer and mule deer are also present.

Slope, stones, and the depth to bedrock are limitations for homesites and roads. The construction of septic tank filter fields is also restricted by these limitations. Both soils in capability subclass VIs.

30-Lacy-Bobbitt stony loams, 35 to 65 percent slopes. These very steep soils are on mountain side slopes and terrace escarpments at elevations of 2,125 feet to 3,000 feet. The average annual precipitation is about 25 inches. Average annual air temperature is about 48 degrees F. This map unit is about 60 percent Lacy stony loam, 35 to 65 percent slopes, and 30 percent Bobbitt stony loam, 35 to 65 percent slopes. These soils are so intricately mixed that they are not shown separately on the soil map. The Lacy soil supports a ponderosa pine-Idaho fescue plant community, and the Bobbitt soil supports a Douglas-fir-snowberry plant community.

Included with these soils in mapping are Blinn stony loam and Rock outcrop. These included soils make up 10 percent of the map unit.

The Lacy soil is shallow, well drained, and stony. It formed in residuum and colluvium derived from basalt with a thin mantle of loess. Permeability is moderate. Effective rooting depth is 10 to 20 inches, and available water capacity is 1 to 2 inches. Surface runoff is very rapid, and the hazard of erosion is very high.

In a typical profile of the Lacy soil the surface layer is brown, neutral stony loam about 4 inches thick. The subsoil is dark brown, slightly acid and medium acid stony clay loam and very stony clay loam about 10 inches thick. Fractured basalt is at a depth of about 14 inches.

The Bobbitt soil is moderately deep, well drained, and stony. It formed in residuum and colluvium derived from basalt with a thin mantle of loess and volcanic ash. Permeability is moderate. Effective rooting depth is 20 to 40 inches, and available water capacity is 2 to 3 inches. Surface runoff is very rapid, and the hazard of erosion is very high.

In a typical profile of the Bobbitt soil the surface layer is brown, neutral stony loam about 4 inches thick. The subsoil is brown, neutral very stony clay loam about 17 inches thick. Fractured basalt is at a depth of about 21 inches.

These Lacy and Bobbitt soils are used for woodland, wildlife habitat, recreation, and limited grazing.

The Lacy soil is suited to the production of ponderosa pine. It is capable of producing about 3,400 cubic feet per acre 0.6 inch and more in diameter or 3,500 board feet (Scribner rule) of merchantable timber 11.6 inches and more in diameter from an unmanaged stand of 80 year old trees.

The Bobbitt soil is suited to the production of Douglas-fir and ponderosa pine. It is capable of producing about 5,900 cubic feet per acre 0.6 inch and more in diameter or 18,500 board feet (Scribner rule) of merchantable timber 11.6 inches and more in diameter from an unmanaged stand of 80 year old trees.

Depth to bedrock, stones, very steep slopes, and the very high hazard of erosion restrict the use of these soils for timber production. Conventional methods of tree harvest are limited by the slope. Special equipment and methods of logging are needed in places to prevent excessive soil losses.

The soils in this map unit have potential for grazing, especially where the tree canopy is opened by logging or fire. Seeding disturbed areas of these soils to adapted grasses increases vegetation cover. Important forage plants are seeded grasses, Idaho fescue, bluebunch wheatgrass, arrowleaf balsamroot, and geranium. Shrubs can dominate the vegetation on the Bobbitt soil once the canopy is opened. Management of vegetation should be designed to protect timber regeneration, to provide good vegetation cover, and to increase production of Idaho fescue and bluebunch wheatgrass.

These soils produce forage for livestock and big game animals continually under woodland management. The total annual forage production on the Lacy soil varies from 1,600 pounds of air-dry forage to less than 200 pounds per acre as the canopy closes. The total annual production on the Bobbitt soil varies from 2,000 pounds of air-dry forage to less than 200 pounds per acre as the canopy closes. The type of grazing management is also important in forage production. Very steep slopes limit livestock movement and forage accessibility.

These soils have potential as woodland wildlife habitat for small animals such as chipmunks, squirrels, some game birds, and songbirds. They are also used as winter range for big game animals.

Very steep slopes, stoniness, and depth to bedrock are limitations for construction of homesites and roads. Roads are difficult to maintain because of the very high hazard of erosion. Both soils in capability subclass VIIs.

31-Lacy-Rock outcrop complex, 5 to 35 percent slopes. This rolling to steep map unit is on basaltic mountain side slopes and canyons at elevations of 2,125 to 3,000 feet. The average annual precipitation is about 25 inches. Average annual air temperature is about 48 degrees F. This unit is 55 percent Lacy stony loam and about 35 percent Rock outcrop. The Lacy soil supports a ponderosa pine-snowberry plant community.

Included with these soils in mapping is Bobbitt stony loam. This included soil makes up 10 percent of the map unit.

The Lacy soil is shallow, well drained, and stony. It formed in material weathered from basalt and has a small amount of loess in the upper part. Permeability is moderate. Effective rooting depth is 10 to 20 inches, and available water capacity is 1 to 2 inches. Surface runoff is rapid, and the hazard of erosion is high.

In a typical profile of the Lacy soil the surface layer is brown, neutral stony loam about 4 inches thick. The subsoil is Clark brown, slightly acid to medium acid stony clay loam and very stony clay loam about 10 inches thick. Fractured basalt is at a depth of about 14 inches.

Rock outcrop consists mostly of exposures of bare basalt. In places crevices in the rock contains some soil material. Vegetation is mostly moss and lichens.

The Lacy soil is used for woodland, recreation, and wildlife habitat. It is suited to the production of ponderosa pine. It is capable of producing about 3,400 cubic feet per acre 0.6 inch and more in diameter or 3,500 board feet (Scribner rule) of merchantable timber 11.6 inches and more in diameter from an unmanaged stand of 80 year old trees. Stones and the shallow depth to bedrock restrict the use of the Lacy soil for timber production. Trees can be harvested by conventional methods, but road construction is difficult. Rock outcrop adds to the difficulty of timber harvest and road construction.

This unit provides very little grazing for domestic livestock. The total annual production of the Lacy soil varies from 1,600 pounds of air-dry forage per acre to less than 100 pounds as the canopy closes.

The Lacy soil has potential as woodland wildlife habitat for certain small animals and as winter range for deer and elk. The vegetation cover is limited by the depth to bedrock and by stones.

Areas of this map unit have poor potential as homesites because of depth to bedrock, stones, and Rock outcrop. Septic tank filter fields or other excavations are not practical. Capability subclass VIIs.

32-Larkin silt loam, 3 to 12 percent slopes. This undulating to rolling soil is very deep and well drained. It is on loess hills at elevations of about 2,300 to 2,800 feet. It formed in loess that contains volcanic ash. This soil supports a ponderosa pine-ninebark plant community. The average annual precipitation is about 23 inches. Average annual air temperature is about 47 degrees F.

Included with this soil in mapping are areas of Taney silt loam, Southwick silt loam, Worley silt loam, and Garfield silty clay loam. These included soils have slopes of 3 to 12 percent.

This soil has moderately slow permeability. Effective rooting depth is 60 inches, and available water capacity is 11 to 13 inches. Surface runoff is medium, and the hazard of erosion is moderate.

In a typical profile the surface layer is dark grayish brown, slightly acid silt loam about 27 inches thick. The subsoil is brown and light yellowish brown, medium acid to mildly alkaline silt loam and silty clay loam to a depth of more than 60 inches.

This Larkin soil is used mainly for crops, hay, pasture, and woodland. Chief crops are wheat, barley, peas, and grass seed. Under good management, this soil has good production of all suitable crops. An adequate conservation program can be achieved with a continuous cropping system such as small grain and peas along with minimum tillage and crop residue utilization. Grassed waterways are needed to prevent gullies from forming in the natural drainageways where runoff is significant. Other desirable practices for erosion control are contour farming, divided slope farming, diversions, gradient terraces, and field stripcropping. Legume-grass crops also help in erosion control. Applications of nitrogen, sulfur, and occasional phosphorous fertilizers are necessary in all cropping systems. Chemical weed control is also beneficial to crop yields.

This soil is suited to the production of ponderosa pine. It is capable of producing about 5,900 cubic feet per acre 0.6 inch and more in diameter or 18,500 board feet (Scribner rule) of merchantable timber 11.6 inches and more in diameter from an unmanaged stand of 80 year old trees. Poor trafficability during winter and spring restricts the use of this soil for timber production. Trees can be harvested by conventional methods, but these methods can be restricted during the rainy period. Carefully managed reforestation after harvest reduces plant competition of undesirable understory plants.

This soil has good potential for grazing, especially where the canopy has been opened by logging or fire. Seeding disturbed areas of this soil to adapted grasses increases forage production. Important forage plants are seeded grasses, Idaho fescue, bluebunch wheatgrass, blue wildrye, bluegrass, hawkweed, and arrowleaf balsamroot. Tall shrubs can dominate the vegetation once the canopy is opened. Management of vegetation should be designed to protect timber regeneration and to increase production of Idaho fescue and bluebunch wheatgrass.

This soil produces forage for livestock and big game animals continually under woodland management. If not managed, forage is produced for 15 to 25 years. The total annual production varies from 2,000 pounds of air-dry forage per acre to less than 100 pounds per acre as the canopy closes. The type of grazing management is important in production of forage on this soil.

This Larkin soil has potential as openland or woodland wildlife habitat. White-tailed deer, black bear, small rodents, ruffed grouse, and songbirds use wooded areas of this soil. Cultivated areas are suited to ring-necked pheasant, Hungarian partridge, and mourning dove. Populations can be increased by planting shrubs along fences and roadways to provide additional cover and protection

A moderate shrink-swell potential and the limited ability of this soil to support a load restrict the use of this soil for homesites. If footings are not placed below the frost line, frost heaving can be a concern. These limitations can be offset by modifying the design of dwellings and roads. Septic tank absorption fields do not function properly because of the moderately slow permeability. In areas of moderate to high density population community sewage systems are needed. Capability subclass IIIe.

33-Larkin silt loam, 12 to 20 percent slopes. This rolling to hilly soil is very deep and well drained. It is on loess hills at elevations of about 2,300 to 2,800 feet. It formed in loess that contains volcanic ash. This soil supports a ponderosa pine-ninebark plant community. The average annual precipitation is about 23 inches. Average annual air temperature is about 47 degrees F.

Included with this soil in mapping are areas of Taney silt loam, Southwick silt loam, Worley silt loam, and Garfield silty clay loam. These included soils have slopes of 12 to 20 percent.

This soil has moderately slow permeability. Effective rooting depth is 60 inches, and available water capacity is 11 to 13 inches. Surface runoff is rapid, and the hazard of erosion is high.

In a typical profile the surface layer is dark grayish brown, slightly acid silt loam about 27 inches thick. The subsoil is brown and light yellowish brown, medium acid to mildly alkaline silt loam and silty clay loam to a depth of more than 60 inches.

This Larkin soil is used mainly for crops, hay, pasture, and woodland. Chief crops are wheat, barley, peas, and grass seed. Under good management, this soil has good production of all suitable crops. An adequate conservation program can be achieved with a continuous cropping system such as small grain and peas, along with minimum tillage and crop residue utilization. Steepness of the slopes imposes an erosion hazard that requires additional support from field strips and divided slope farming. Grassed waterways are needed to prevent gullies from forming in natural drainageways where runoff is significant. Other desirable practices for erosion are contour farming, diversions, and gradient terraces. Legume-grass crops in strips are also beneficial in erosion' control. Applications of nitrogen, sulfur, and occasional phosphorus fertilizers are needed in all cropping systems. Chemical weed control is also beneficial to crop yields.

This soil is suited to the production of ponderosa pine. It is capable of producing about 5,900 cubic feet per acre 0.6 inch and more in diameter or 18,500 board feet (Scribner rule) of merchantable timber 11.6 inches and more in diameter from an unmanaged stand of 80 year old trees. Poor trafficability during winter and spring restricts the use of this soil for timber production. Trees can be harvested by conventional methods, but these methods can be restricted during the rainy period. Carefully managed reforestation after harvest reduces plant competition of undesirable understory plants.

This soil has good potential for grazing, especially where the canopy has been opened by logging or fire. Seeding disturbed areas of this soil to adapted grasses increases forage production. Important forage plants are seeded grasses, Idaho fescue, bluebunch wheatgrass, blue wildrye, bluegrass, hawkweed, and arrowleaf balsamroot. Tall shrubs can dominate the vegetation once the canopy is opened. Management of vegetation should be designed to protect timber regeneration and to increase production of Idaho fescue and bluebunch wheatgrass.

This soil produces forage for livestock and big game animals continually under woodland management. If not managed, forage is produced for 15 to 25 years. The total annual production varies from 2,000 pounds of air-dry forage per acre to less than 100 pounds per acre as the canopy closes. The type of grazing management is important in the production of forage on this soil.

This soil has potential as openland or woodland wildlife habitat, Woodland areas provide habitat for white-tailed deer, black bear, small rodents, forest grouse, and songbirds. Cultivated areas provide habitat for ring-necked pheasant, Hungarian partridge, and mourning clove. Population of these birds can be increased by planting shrubs along fences and roads for additional cover and protection.

A moderate shrink-swell potential, the limited ability of this soil to support a load, and slope restrict the use of this soil for homesites and roads. If footings are not placed below the frost line, frost heaving can be a concern. These limitations can be offset by modifying the design of dwellings and roads. Septic tank absorption fields do not function properly because of the moderately slow permeability. In areas of moderate to high density population community sewage systems are needed. Capability subclass IVe.

34-Larkin silt loam, 3 to 20 percent slopes, eroded. This undulating to hilly soil is very deep and well drained. It is on loess hills at elevations of about 2,300 to 2,800 feet. It formed in loess that contains volcanic ash. The average annual precipitation is about 23 inches. Average annual air temperature is about 47 degrees F.

Included with this soil in mapping are areas of Taney silt loam, Southwick silt loam, Worley silt loam, and Garfield silty clay loam. These included soils have slopes of 3 to 20 percent.

This soil has moderately slow permeability. Effective rooting depth is 60 inches, and available water capacity is 11 to 13 inches. Surface runoff is rapid, and the hazard of erosion is high.

In a typical profile the surface layer is dark grayish brown, slightly acid silt loam about 14 inches thick. The subsoil is brown and light yellowish brown, medium acid to mildly alkaline silt loam and silty clay loam to a depth of 60 inches.

This soil is used mainly for wheat, barley, peas, grass seed, hay, and pasture. Much of the topsoil has been lost. High moisture stress and runoff are hazards and tend to reduce the yields of most crops. This soil is intermingled with the uneroded Larkin soil and mainly receives the same management.

An adequate conservation program for this Larkin soil can be achieved by using a continuous cropping system with minimum tillage and crop residue. However, it also needs field stripcropping. Peas or lentils do not provide sufficient residue for soil protection and are not adequate as part of the cropping system. Grass-legume crops in strips are appropriate for this soil. Chemical weed control is also beneficial to crops. Applications of nitrogen, sulfur, and phosphorus fertilizers are needed in cropping systems.

This Larkin soil is suited to the production of ponderosa pine. It is capable of producing about 5,900 cubic feet per 0.6 inch and more in diameter or 18,500 board feet (Scribner rule) of merchantable timber 11.6 inches and more in diameter from an unmanaged stand of 80 year old trees.

Poor trafficability during winter and spring restricts the use of this soil for timber production. Trees can be harvested by conventional methods, but these methods can be restricted during the rainy period. Carefully managed reforestation after harvest reduces plant competition of undesirable understory plants.

This Larkin soil has potential for grazing. Seeding disturbed areas of this soil to adapted grasses increases forage production. Important forage plants are seeded grasses, Idaho fescue, bluebunch wheatgrass, blue wildrye, bluegrass, hawkweed, and arrowleaf balsamroot. Tall shrubs can dominate the vegetation once the canopy is opened. Management of vegetation should be designed to protect timber regeneration and to increase production of Idaho fescue and bluebunch wheatgrass.

This soil produces forage for livestock and big game animals continually under woodland management. If not managed, forage is produced for 20 to 30 years. The total annual production varies from 1,800 pounds of air-dry herbage per acre to less than 100 pounds per acre as the canopy closes. The type of grazing management is important in the production of forage on this soil.

This Larkin soil has potential as openland and woodland wildlife habitat. Woodland areas provide habitat for white-tailed deer, black bear, small rodents, forest grouse, and songbirds. Cultivated areas provide habitat for ring-necked pheasant, Hungarian partridge, and mourning dove. Populations of these birds can be increased by planting shrubs along fences and roads to provide needed cover and protection.

The limited ability of this soil to support a load, a moderate shrink-swell potential, and slope restrict the use of this soil for homesites and roads. If footings are not placed below the frost line, frost heaving can be a concern. These limitations can be offset by modifying the design of dwellings and roads. Septic tank absorption fields do not function properly because of the moderately slow permeability. In areas of moderate to high density population community sewage systems are needed. Capability subclass IVe.

35-Latahco silt loam, 0 to 2 percent slopes. This soil is very deep and somewhat poorly drained. It is on low terraces and bottom lands and in drainageways associated with loess hills at elevations of 2,600 to 3,200 feet. It formed in alluvium derived from the loess uplands. The average annual precipitation is about 20 inches. The average annual air temperature is about 43 degrees F.

Included with this soil in mapping are areas of Cald silt loam, 0 to 2 percent slopes, and Thatuna silt loam, 3 to 7 percent slopes. Also included are small areas of Lovell silt loam and Moctileme silt loam that have slopes of 0 to 2 percent.

This soil has moderately slow permeability. Effective rooting depth is 60 inches, and available water capacity is 11 to 13 inches. This soil has a seasonal high water table at a depth of 6 to 30 inches in April and May and is occasionally flooded for brief periods early in spring. Surface runoff is slow, and the hazard of erosion is slight.

In a typical profile the surface layer is dark gray, slightly acid to neutral silt loam about 17 inches thick. The subsurface layer is gray and light gray, neutral silt loam about 4 inches thick. The subsoil is grayish brown and light brownish gray, mildly alkaline and moderately alkaline silty clay loam and silt loam about 30 inches thick. The substratum is mottled, light gray silt loam to a depth of more than 60 inches.

Most areas of this soil are in cultivated crops. Some remnants of shrub and woodland vegetation are in narrow strips along streams in the cropland. This soil is used mainly for small grain. A limited acreage is used for hay, pasture, and grass seed. The high water table and cold soil temperature affect the choice of crops to some extent. Alfalfa is generally short-lived, and production of peas and lentils is commonly low. This soil is well suited to a continuous cropping system, and production is good when crops are adequately fertilized and drained. In places, subsurface drainage and land smoothing are needed to correct seepage and to improve surface water removal. Stubble utilization and continuous cropping keep soil losses to a minimum. Application of nitrogen, sulfur, and occasional phosphorus fertilizers are needed in all cropping systems to maintain high production.

This soil is suited to the production of ponderosa pine. It is capable of producing about 9,950 cubic feet per acre 0.6 inch and more in diameter or 43,900 board feet (Scribner rule) of merchantable timber 11.6 inches and more in diameter from an unmanaged stand of 80 year old trees. During winter and spring, flooding and ponding restrict the use of this soil for timber production. Trees can be harvested by conventional methods, although rainy periods can restrict the use of these methods. Carefully managed reforestation after harvest reduces plant competition of undesirable understory plants.

This Latahco soil has potential as woodland and wetland wildlife habitats. Woodland areas are used by white-tailed deer, black bear, small rodents, forest grouse, and songbirds. These animals along with waterfowl also use the wetland areas.

The hazard of flooding, a seasonal high water table, a high potential frost action, and the limited ability of this soil to support a load are limitations for community development and sanitary facilities. Community sewage systems are needed because septic tank absorption fields do not function properly because of the moderately slow permeability and high water table. Capability subclass IIIw.

36-Latahco-Lovell silt loams, 0 to 2 percent slopes. These soils are level and nearly level. They are on low terraces and bottom lands and in drainageways at elevations of about 2,600 to 3,200 feet. The average annual precipitation is about 20 inches. The average annual air temperature is about 43 to 45 degrees F. This map unit is about 45 percent Latahco silt loam and about 30 percent Lovell silt loam. These soils are so intricately intermingled that they are not shown separately on the soil map.

Included with these soils in mapping are about 15 percent Cald silt loam and 10 percent Thatuna silt loam.

The Latahco soil is very deep and somewhat poorly drained. It formed in alluvium derived from surrounding loess hills. Permeability is moderately slow. Effective rooting depth is more than 60 inches, and available water capacity is 11 to 13 inches. Surface runoff is slow, and the hazard of erosion is slight. This soil has a seasonal high water table at a depth of 6 to 30 inches in April and May and is occasionally flooded by brief periods during spring.

In a typical profile of the Latahco soil the surface layer is dark gray, slightly acid to neutral silt loam about 17 inches thick. The next layer is gray and light gray, neutral silt loam about 4 inches thick. The subsoil is grayish brown and light brownish gray, mildly alkaline and moderately alkaline silty clay loam and silt loam about 30 inches thick. The substratum to a depth of more than 60 inches is light gray, moderately alkaline silt loam that has distinct mottles.

The Lovell soil is very deep and somewhat poorly drained. It formed in alluvium derived from loess, basalt, metasedimentary rock, and volcanic ash. Permeability is moderately slow. Effective rooting depth is 60 inches, and available water capacity is 10 to 12 inches. Surface runoff is slow, and the hazard of erosion is slight. This soil has a seasonal high water table at a depth of 18 to 24 inches from February to May. This soil is frequently flooded for brief periods in spring.

In a typical profile of the Lovell soil the surface layer is light brownish gray, medium acid silt loam about 8 inches thick. The subsurface layer is gray, medium acid silt loam about 10 inches thick. The subsoil is gray, light gray, light yellowish brown, and very pale brown, neutral silt loam and loam about 33 inches thick. The substratum to a depth of 60 inches or more is light gray, neutral, mottled loam.

Most areas of this map unit are in cultivated crops. Some remnants of shrub and woodland vegetation are in narrow strips along some streams in the cropland.

The soils in this map unit are used mainly for small grain. A limited acreage is used for hay, pasture, and grass seed. Poor drainage and the cool temperature affect the choice of crops. Alfalfa is generally short-lived, and production of peas and lentils is low. These soils are well suited to a continuous cropping system, and production is good when crops are adequately fertilized and drained. Subsurface drainage and land smoothing are commonly needed to correct seepage and improve surface water removal. Stubble utilization and continuous cropping keep soil losses to a minimum. Application of nitrogen, sulfur, and occasional phosphorus fertilizers are needed in all cropping systems for sustained high production. Fall application of nitrogen fertilizer on winter wheat is discouraged because of loss of nitrogen during winter.

The Latahco soil is suited to the production of ponderosa pine. It is capable of producing about 11,650 cubic feet per acre 0.6 inch and more in diameter or 54,950 board feet (Scribner rule) of merchantable timber 11.6 inches and more in diameter from an unmanaged stand of 80 year old trees.

The Lovell soil is also suited to production of ponderosa pine. It is capable of producing about 7,100 cubic feet per acre 0.6 inch and more in diameter or 26,000 board feet (Scribner rule) of merchantable timber 11.6 inches and more in diameter from an unmanaged stand of 80 year old trees.

During winter and spring, flooding and ponding restrict the use of these soils for timber production. Trees can be harvested by conventional methods, although rainy periods can restrict these methods. Carefully managed reforestation after harvest reduces plant competition of undesirable understory plants.

Important forage plants are blue wildrye, mallow ninebark, pinegrass, and elk sedge. Under heavy grazing, the rose, wildrye, and elk sedge, which are the most palatable plants, decrease in the plant community and the proportion of hawthorn and pinegrass increases. With continued heavy grazing, Kentucky bluegrass invades and dominates the understory vegetation.

These soils have potential as woodland and wetland wildlife habitats for white-tailed deer, black bear, small rodents, forest grouse, and songbirds. Waterfowl use the wetland areas.

The hazard of flooding (fig. 5), the seasonal high water table, a high potential frost action, and the limited ability of these soils to support a load are limitation for buildings, road construction, and sanitary facilities. Community sewage systems are needed because septic tank absorption fields do not function properly because of the high water table and moderately slow permeability. Capability subclass IIIw.

37-Lovell silt loam. This level soil is very deep and somewhat poorly drained. It is on flood plains and in basins at elevations of 2,125 to 2,800 feet. It formed in alluvium derived from loess, basalt, metasedimentary rock, and volcanic ash. The average annual precipitation is about 20 inches. Average annual air temperature is about 44 degrees F.

Included with this soil in mapping are areas of Latahco silt loam, Cald silt loam, and Moctileme silt loam. These soils have slopes of 0 to 2 percent. Also included is Thatuna silt loam that has slopes of 3 to 7 percent.

This soil has moderately slow permeability. Effective rooting depth is 60 inches or more, and available water capacity is about 10 to 12 inches. Surface runoff is very slow, and the hazard of erosion is slight. This soil has a seasonal high water table at a depth of 18 to 24 inches from February to May. It is frequently flooded for brief periods early in spring.

In a typical profile the surface layer is light brownish gray, medium acid silt loam about 8 inches thick. The subsurface layer is gray, slightly acid silt loam about 10 inches thick. The subsoil is gray, light gray, light yellowish brown, and very pale brown, neutral silt loam and loam about 33 inches thick. The substratum is mottled, light gray, neutral loam to a depth of 60 inches or more.

Most areas of this soil are in cultivated crops. Some remnants of shrub and woodland vegetation are in narrow strips along steams in the cropland. This soil is used mainly for small grain. A limited acreage is used for hay, pasture, and grass seed. The seasonal high water table and cold soil temperature affect the choice of crops. Alfalfa is generally short-lived, and production of peas and lentils is low. This soil is suited to a continuous system, and production is good when crops are adequately fertilized and drained. In places, tile drainage and land smoothing are needed to correct seepage and to improve surface water removal. Stubble utilization and continuous cropping keep soil losses to a minimum. Applications of nitrogen, sulfur, and occasional phosphorus are needed in all cropping systems to maintain high production. Fall application of nitrogen fertilizer on winter wheat is discouraged because of denitrification during winter.

Vegetation on this soil consists mostly of ponderosa pine. The understory includes Douglas hawthorn, woods rose, blue wildrye, mallow ninebark, pinegrass, and elk sedge. Under heavy grazing, rose, wildrye, elk sedge, and palatable plants decrease in the plant community and the proportion of hawthorn and pinegrass increases. With continued heavy grazing Kentucky bluegrass invades and dominates the understory vegetation.

This soil is suited to the production of ponderosa pine. It is capable of producing about 7,100 cubic feet per acre 0.6 inch and more in diameter or 26,000 board feet (Scribner rule) of merchantable timber 11.6 inches and more in diameter from an unmanaged stand of 80 year old trees. During the rainy winter and spring months, flooding restricts the use of this soil for timber production. Trees can be harvested by conventional methods, but rainy periods can restrict these methods. Carefully planned reforestation after harvest reduces plant competition.

This Lovell soil has potential as woodland and wetland wildlife habitats for white-tailed deer, black bear, rodents, forest grouse, and songbirds. Waterfowl use the wetland areas.

The hazard of flooding, a seasonal high water table, a high potential frost action, and the limited ability of this soil to support a load are limitations for homesite development and sanitary facilities. Dwellings and road construction can be designed to offset these limitations. Community sewage systems are needed because septic tank absorption fields do not function properly because of the high water table and moderately slow permeability. Capability subclass IIIw.

38-McCrosket-Ardenvoir association, steep. This map unit consists of steep soils on mountains at elevations of 2,500 to 4,000 feet. It is about 55 percent McCrosket gravelly silt loam, 20 to 35 percent slopes, and about 35 percent Ardenvoir gravelly loam, 20 to 35 percent slopes. The McCrosket soil is on southerly exposures and ridgetops. The Ardenvoir soil has northerly exposures and is in swales. The McCrosket soil supports a Douglas-fir-ninebark plant community, and the Ardenvoir supports a grand fir-pachistima plant community.

Included with these soils in mapping are areas of Taney, Tekoa, and Schumacher soils. These included soils have slopes of 20 to 35 percent and make up about 10 percent of the map unit.

The McCrosket soil is deep and well drained over weathered metasedimentary bedrock. It formed in material weathered from metasediment rock with a mantle of loess. Permeability is moderate. Effective rooting depth is 40 to 60 inches, and available water capacity is 4 to 5 inches. Surface runoff is rapid, and the hazard of erosion is high. The average annual precipitation is about 25 inches. Average annual air temperature is about 47 degrees F.

In a typical profile of the McCrosket soil the surface layer is dark grayish brown and brown, neutral gravelly silt loam about 11 inches thick. The subsoil is light yellowish brown and very pale brown, medium acid very gravelly silt loam and very stony silt loam about 31 inches thick. Weathered metasedimentary bedrock is at a depth of about 42 inches.

The Ardenvoir soil is deep and well drained over weathered metasedimentary bedrock. It formed in material weathered from metasediment rock with a mantle of loess and volcanic ash. Permeability is moderate. Effective rooting depth is 40 to 60 inches, and available water capacity is 4 to 6 inches. Surface runoff is rapid, and the hazard of erosion is high. The average annual precipitation is about 29 inches, including 5 to 10 feet of snow. Average annual air temperature is about 42 degrees F.

In a typical profile of the Ardenvoir soil the surface layer is brown and light yellowish brown, neutral and slightly acid gravelly loam about 9 inches thick. The subsoil is very pale brown, slightly acid gravelly loam about 8 inches thick. The substratum is very pale brown, medium acid very cobbly loam and very flaggy loam about 29 inches thick. Weathered metasedimentary bedrock is at a depth of about 46 inches.

The soils in this map unit are used for timber production, grazing, wildlife habitat, and recreation.

The McCrosket soil is suited to the production of ponderosa pine and Douglas-fir. It is capable of producing about 7,100 cubic feet per acre 0.6 inch and more in diameter or 26,000 board feet per acre (Scribner rule) of merchantable timber 11.6 inches and more in diameter from an unmanaged stand of 80 year old trees. Steep slopes and the high hazard of erosion restrict the use of the McCrosket soil for timber production. Care must be exercised in the selection of landings and skid trails to minimize soil losses. Carefully managed reforestation after harvest prevents brush encroachment on new seedlings.

The McCrosket soil has potential for grazing where the tree canopy is opened by logging, fire, or some other disturbance. Seeding disturbed areas of this soil to adapted grasses increases forage production and helps protect the soil. Important forage plants are seeded grasses, elk sedge, mountain maple, and red-stem ceanothus. Creambush oceanspray and mallow ninebark, two relatively unpalatable shrubs, tend to dominate the vegetation once the canopy is opened. Management of vegetation should be designed to protect timber regeneration and to insure adequate litter for soil protection.

The Ardenvoir soil is suited to the production of grand fir, Douglas-fir, and western larch. It is capable of producing about 5,900 cubic feet per acre 0.6 inch and more in diameter or 18,500 board feet (Scribner rule) of merchantable timber 11.6 inches and more in diameter from an unmanaged stand of 80 year old trees. Steep slopes and the high hazard of erosion restrict the use of the Ardenvoir soil for timber production. Special equipment and methods of operation are needed to keep soil losses to a minimum. Brush encroachment on the Ardenvoir soil prevents adequate natural or artificial regeneration without proper management.

The McCrosket soil produces forage for livestock and big game animals for 20 to 30 years following opening of the canopy. During this period, the total annual production varies from about 1,800 pounds of air-dry forage per acre to less than 200 pounds per acre as the canopy closes.

The Ardenvoir soil has potential for grazing where the tree canopy is opened by logging, fire, or some other disturbance. Seeding disturbed areas of this soil to adapted grasses increases forage production and helps protect the soil. Important forage plants are seeded grasses, elk sedge, mountain maple, and red-stem ceanothus. Creambush oceanspray and mallow ninebark, two relatively unpalatable shrubs, tend to dominate the vegetation once the canopy is opened. Management of vegetation should be designed to protect timber regeneration and to insure adequate litter for soil protection.

The Ardenvoir soil produces forage for livestock and big game animals for 20 to 30 years following opening of the canopy. During this period, the total annual production varies from about 1,500 pounds of air-dry forage per acre to less than 200 pounds per acre as the canopy closes.

The soils in this unit provide woodland wildlife habitat for white-tailed deer, elk, black bear, chipmunks, squirrels, and forest grouse.

Slope, large stones in the soil, and depth to bedrock are limitations in the construction of homes, cabins, and roads. The soils are also inaccessible.

Steep slopes, dust, and small stones are limitations for the use of these soils as trails and camp areas. Both soils in capability subclass VIe.

39-McCrosket-Ardenvoir association, very steep. This map unit consists of very steep soils on mountains at elevations of 2,500 to 4,000 feet. It is about 55 percent McCrosket gravelly silt loam, 35 to 65 percent slopes, and about 35 percent Ardenvoir gravelly loam, 35 to 65 percent slopes. The McCrosket soil is on southerly exposures and ridgetops. It supports a Douglas-fir-ninebark plant community. The Ardenvoir soil has northerly exposures and is in swales. It supports a grand fir-pachistima plant community. The McCrosket soil has a dark colored surface layer more than 10 inches thick. The Ardenvoir soil has a light colored surface layer.

Included with these soils in mapping are areas of Taney, Tekoa, and Schumacher soils that have slopes of 35 to 65 percent. These included soils make up about 10 percent of the total map unit.

The McCrosket soil is deep and well drained over weathered metasedimentary bedrock. It formed in a mantle of loess and material weathered from metasedimentary rock. Permeability is moderate. Effective rooting depth is 40 to 60 inches, and available water capacity is 4 to 5 inches. Surface runoff is very rapid, and the hazard of erosion is very high. The average annual precipitation is about 25 inches, and the average annual air temperature is about 47 degrees F.

In a typical profile of the McCrosket soil the surface layer is Clark grayish brown and brown, neutral gravelly silt loam about 11 inches thick. The subsoil is about 31 inches thick. It is light yellowish brown and very pale brown, medium acid very gravelly silt loam and very stony silt loam. Weathered metasedimentary bedrock is at a depth of about 42 inches.

The Ardenvoir soil is deep and well drained over weathered metasedimentary bedrock. It formed in material weathered from metasedimentary bedrock with a mantle of loess and volcanic ash. Permeability is moderate. Effective rooting depth is 40 to 60 inches, and available water capacity is 4 to 6 inches. Surface runoff is very rapid, and the hazard of erosion is very high. The average annual precipitation is about 29 inches, including 5 to 10 feet of snow. Average annual air temperature is about 42 degrees F.

In a typical profile of the Ardenvoir soil the surface layer is brown and light yellowish brown, neutral and slightly acid, gravelly loam about 9 inches thick. The subsoil is very pale brown, slightly acid, gravelly loam about 8 inches thick. The substratum is very pale brown, medium acid very cobbly loam and very flaggy loam about 29 inches thick. Weathered metasedimentary bedrock is at a depth of about 46 inches.

The soils in this map unit are used for timber production, wildlife habitat, and watershed.

The McCrosket soil is suited to the production of ponderosa pine and Douglas-fir. It is capable of producing about 7,000 cubic feet per acre 0.6 inch and more in diameter or 26,000 board feet (Scribner rule) of merchantable timber 11.6 inches and more in diameter from an unmanaged stand of 80 year old trees. Slopes and the hazard of erosion restrict timber production. Conventional logging methods are severely limited and alternative methods are needed to keep soil losses to a minimum. Carefully managed reforestation after harvest prevents brush encroachment on new seedlings.

The McCrosket soil has potential for grazing where the canopy is opened by logging, fire, or some other disturbance. Seeding disturbed areas to adapted grasses increases vegetation cover and helps protect the soil. Important forage plants are seeded grasses, elk sedge, mountain maple, and red-stem ceanothus. Creambush oceanspray and mallow ninebark, two relatively unpalatable shrubs, tend to dominate the vegetation once the canopy is opened. Management of vegetation should be designed to protect timber regeneration, to provide good vegetation cover, and to insure adequate litter for soil protection.

The McCrosket soil produces forage for livestock and big game animals for 20 to 30 years following opening of the canopy. During this period, the total annual production varies from about 1,500 pounds of air-dry forage per acre to less than 200 pounds per acre as the canopy closes. The very steep slope limits livestock movement and forage accessibility.

The Ardenvoir soil is suited to the production of grand fir, Douglas-fir and western larch. It is capable of producing about 7,750 cubic feet per acre 0.6 inch and more in diameter or 6,500 board feet (Scribner rule) of merchantable timber 11.6 inches and more in diameter from an unmanaged stand of 80 year old trees. Slopes and the hazard of erosion restrict timber production. Special equipment and methods of operation are needed to keep soil losses to a minimum. Brush encroachment on this soil prevents adequate natural or artificial regeneration without proper management.

The Ardenvoir soil has potential for grazing where the canopy is opened by logging, fire, or some other disturbance. Seeding disturbed areas of this soil to adapted grasses increases vegetation cover and helps protect the soil. Important forage plants are seeded grasses, elk sedge, mountain maple, and red-stem ceanothus. Creambush oceanspray and mallow ninebark, two relatively unpalatable shrubs, tend to dominate the vegetation once the canopy is opened. Management of vegetation should be designed to protect timber regeneration, to provide good plant cover, and to insure adequate litter for soil protection.

The Ardenvoir soil produces forage for livestock and big game animals for 20 to 30 years following opening of the canopy. During this period, the total annual production varies from about 1,800 pounds of air-dry forage per acre to less than 200 pounds per acre as the canopy closes. The very steep slope limits livestock movement and forage accessibility.

The soils in this map unit provide woodland wildlife habitat for white-tailed deer, elk, black bear, chipmunks, squirrels, and grouse.

The very steep slope limits construction of homes, cabins, and roads. These soils are not used for homesites because of inaccessibility.

Very steep slopes, dust, and small stones are limitations for such recreational developments as trails and camp areas. Both soils in capability subclass VIIe.

40-McCrosket-Tekoa association, very steep. This map unit consists of very steep soils on mountains at elevations of 2,500 to 4,000 feet. It is about 60 percent McCrosket gravelly silt loam, 35 to 65 percent slopes, and 35 percent Tekoa shaly silt loam, 35 to 65 percent slopes. The McCrosket soil is on the more northerly positions and in swales. It supports a Douglas-fir-ninebark plant community. The Tekoa soil is on drier aspects on south slopes and ridgetops. It supports a Douglas-fir-snowberry plant community.

Included with these soils in mapping are areas of Ardenvoir and Schumacher soils. These included soils make up about 5 percent of the map unit.

The McCrosket soil is deep and well drained over weathered metasedimentary bedrock. It formed in loess and material weathered from metasedimentary rock. Permeability is moderate. Effective rooting depth is 40 to 60 inches, and available water capacity is 4 to 5 inches. Surface runoff is very rapid, and the hazard of erosion is very high. The average annual precipitation is about 25 inches. Average annual air temperature is about 47 degrees F.

In a typical profile of the McCrosket soil the surface layer is Clark grayish brown and brown, neutral gravelly silt loam about 11 inches thick. The subsoil is light yellowish brown and very pale brown, medium acid very gravelly silt loam and very stony silt loam about 31 inches thick. Weathered metasedimentary bedrock is at a depth of about 42 inches.

The Tekoa soil is moderately deep and well drained over weathered shale. It formed in residuum derived from shale or sandstone with a mantle of loess and volcanic ash. Permeability is moderate. Effective rooting depth is 20 to 40 inches, and available water capacity is about 3 inches. Surface runoff is very rapid, and the hazard of erosion is very high. The average annual precipitation is about 22 inches. Average annual air temperature is about 47 degrees F.

In a typical profile of the Tekoa soil the surface layer is Clark grayish brown, neutral shaly silt loam about 11 inches thick. The subsoil is brown and yellowish brown, neutral shaly and very shaly silt loam about 18 inches thick. Weathered shale is at a depth of about 29 inches.

The soils of this map unit are used for timber production, wildlife habitat, and watershed.

The McCrosket soil is suited to the production of Douglas-fir and ponderosa pine. It is capable of producing about 7,100 cubic feet 0.6 inch and more in diameter or 26,000 board feet per acre (Scribner rule) of merchantable timber 11.6 inches and more in diameter from an unmanaged stand of 80 year old trees. Very steep slopes and the very high hazard of erosion restrict the use of the McCrosket soil for timber production. Conventional methods for tree harvest are severely limited, and special methods and equipment are needed to keep soil losses to a minimum. Carefully manage reforestation after harvest prevents brush encroachment on new seedlings.

The McCrosket soil has some potential for grazing where the tree canopy is opened by logging, fire, or some other disturbance. Seeding disturbed areas of this soil to adapted grasses increases vegetation cover and helps protect the soil. Important forage plants are seeded grasses, elk sedge, mountain maple, and red-stem ceanothus. Creambush oceanspray and mallow ninebark, two relatively unpalatable shrubs, tend to dominate the vegetation once the canopy is opened. Management of vegetation should be designed to protect timber regeneration, to provide good vegetation cover, and to insure adequate litter for soil protection.

The McCrosket soil produces forage for livestock and big game animals for 20 to 30 years following opening of the canopy. During this period, the total annual production varies from about 1,800 pounds of air-dry forage per acre to less than 200 pounds per acre as the canopy closes. Very steep slopes limit livestock grazing and accessibility of forage.

The Tekoa soil is suited to the production of ponderosa pine and Douglas-fir. It is capable of producing about 5,900 cubic feet per acre 0.6 inch and more in diameter or 18,500 board feet per acre (Scribner rule) of merchantable timber 11.6 inches and more in diameter from an unmanaged stand of 80 year old trees. Very steep slopes and the very high hazard of erosion restrict the use of the Tekoa soil for timber production. Conventional methods for tree harvest are severely limited, and alternative methods are needed to keep soil losses to a minimum. Carefully managed reforestation after harvest prevents brush encroachment on new seedlings.

The Tekoa soil has some potential for grazing where the tree canopy is opened by logging, fire, or some other disturbance. Seeding disturbed areas of this soil to adapted grass increases vegetation cover and helps protect the soil. Important native forage plants are elk sedge, mountain maple, red-stem ceanothus, pinegrass, and Idaho fescue. Low shrubs tend to dominate the vegetation once the canopy is opened. Management of vegetation should be designed to protect timber regeneration, to provide good vegetation cover, and to insure adequate litter for soil protection.

The Tekoa soil produces forage for livestock and big game animals for 20 to 30 years following opening of the canopy. During this period, the total production varies from about 1,800 pounds of air-dry forage per acre to less than 200 pounds per acre as the canopy closes. Very steep slopes limit livestock movement and accessibility of forage.

The soils of this map unit have potential as woodland wildlife habitat for white-tailed deer, mule deer, elk, forest grouse, squirrels, chipmunks, black bear, and various songbirds.

Very steep slopes and depth to. bedrock are limitations in the construction of homes, cabins, and roads.

Very steep slopes and dust are the main limitations in development of recreational facilities on these soils. Both soils in capability subclass VIIe.

41-Miesen silt loam. This soil is very deep and somewhat poorly drained. It is on low terraces on flood plains. It formed in alluvium at elevations of 2,125 to 2,150 feet. The average annual precipitation is about 28 inches, including 3 to 5 feet of snow. Average annual air temperature is about 44 degrees F.

Included with this soil in mapping are small areas of Ramsdell silt loam, Pywell muck, and DeVoignes silt loam. These included soils have slopes of 0 to 2 percent.

This soil has moderate permeability. Effective rooting depth is 60 inches, and available water capacity is 10 to 11 inches. This soil has a seasonal high water table that fluctuates between the surface and a depth of 48 inches from February to July. It is flooded annually for very long periods during spring unless protected by levees. Surface runoff is slow, and the hazard of erosion is slight. Channelization, or gully erosion, is possible in unprotected areas during floods.

In a typical profile the upper part of the surface layer is Clark grayish brown, slightly acid and medium acid silt loam about 20 inches thick. The lower part of the surface layer is mottled, grayish brown, medium acid very fine sandy loam and silt loam about 20 inches thick. The substratum is mottled, yellowish brown (moist), medium acid fine sandy loam to a depth of more than 60 inches.

Areas of the Miesen soil that are protected from flooding by dikes or levees are used mainly for wheat, oats, barley, pasture, hay, and grass seed. Small grain is limited to spring planted varieties. This soil supports a plant community dominated by black cottonwood.

Some areas of this soil are artificially drained. In places, drainage is a concern because of poor outlets and cutbanks sloughing. In areas that are continually wet from the high water table, wetland grasses such as meadow foxtail, creeping foxtail, and reed canarygrass can be grown for hay and pasture. Management of these areas need to include cross fencing, pasture rotation, proper grazing, and fertilization.

The Miesen soil has potential for grazing. It is a natural concentration area for livestock because of the extended green feed period and the proximity of this soil to water. Under heavy grazing pressure, the understory vegetation reverts to sod-forming bluegrasses and brush. If properly managed, this soil can be a high producing site and can provide quality forage well into summer.

The Miesen soil is suited to the production of cottonweed and western redcedar. The main limitation in the use of conventional logging methods is inaccessibility during wet periods. Carefully managed reforestation after harvest reduces plant competition of undesirable understory plants.

The Miesen soil has potential as wetland wildlife habitat. Migratory fowl are suitable for this soil. Woodland wildlife, such as white-tailed deer, forest grouse, and songbirds also use areas of this soil.

The seasonal high water table restricts the use of this soil for building sites and roads and for installation of most sanitary facilities. Annual flooding is also a limitation in unprotected areas. Capability subclass IIIw.

42-Miesen-Ramsdell association. This map unit consists of level to nearly level soils on low terraces and flood plains. It is at elevations of 2,125 to 2,200 feet. It is about 60 percent Miesen silt loam, 0 to 1 percent slopes, and about 30 percent Ramsdell silt loam, 0 to 2 percent slopes. The Miesen soil is on low terraces, and the Ramsdell soil is on the flood plains.

Included with these soils in mapping is DeVoignes silt loam, 0 to 1 percent slopes. This included soil makes up about 10 percent of the map unit.

The Miesen soil is very deep and somewhat poorly drained. It formed in alluvium. Permeability is moderate. Effective rooting depth is 60 inches, and available water capacity is 10 to 11 inches. This soil has a seasonal high water table that fluctuates from the surface to a depth of 48 inches from February to July. It is frequently flooded for very long periods during spring unless protected by levees. Surface runoff is slow, and the hazard of erosion is slight. Channelization, or gully erosion, is probable in unprotected areas during annual overflow. The average annual precipitation is about 28 inches, including 3 to 5 feet of snow, and the frost-free season is 100 to 120 days. Average annual air temperature is about 44 degrees F.

In a typical profile of the Miesen soil the upper part of the surface layer is dark grayish brown, slightly acid and medium acid silt loam about 20 inches thick. The lower part of the surface layer is mottled, grayish brown, medium acid very fine sandy loam and silt loam about 20 inches thick. The substratum is mottled, yellowish brown, medium acid fine sandy loam to a depth of more than 60 inches.

The Ramsdell soil is very deep and very poorly drained. It formed in alluvium. Permeability is moderate. Effective rooting depth is 60 inches, and available water capacity is 9 to 13 inches. This soil has a seasonal high water table at a depth of 0 to 24 inches from February to April. It is frequently flooded for long periods early in spring unless protected by levees. Surface runoff is slow and the hazard of erosion is slight. Channelization, or gully erosion, is possible in unprotected areas during annual overflow. The average annual precipitation is about 29 inches, including 3 to 5 feet of snow, and the frost-free season is 100 to 140 clays. Average annual air temperature is about 44 degrees F.

In a typical profile of the Ramsdell soil the surface layer is light gray, medium acid silt loam about 8 inches thick. The subsoil is mottled, light gray, slightly acid and medium acid very fine sandy loam and silt loam about 27 inches thick. The substratum is mottled, light gray, medium acid silt loam to a depth of 60 inches or more.

The soils in this unit, which are protected from flooding, are used mainly for oats, barley, pasture, hay, and grass seed. Grain production is limited to spring planted varieties. Both soils support a plant community dominated by black cottonwood.

Some areas of these soils are artificially drained. Drainage is a concern because of poor outlets and because of cutbanks caving in. Some continually wet areas that have a high water table are planted to wetland grasses such as creeping foxtail, meadow foxtail, or reed canarygrass for hay and pasture. Management of these areas need stream bank protection, pasture and hayland management, and fertilization.

The Miesen and Ramsdell soils are suited to production of cottonwood and western redcedar trees. The main limitations for conventional logging methods are the seasonal high water table and flooding during winter and spring. Plant competition between tree seedling and understory vegetation can be a concern after timber harvest. Carefully managed reforestation minimizes this competition.

The Miesen and Ramsdell soils have potential for grazing. This map unit is a natural concentration area for livestock because of the extended green feed period and the proximity of these soils to water. Under heavy grazing pressure, the understory vegetation reverts to sod-forming bluegrasses and brush. If properly managed, these soils can continually produce a high amount of quality forage well into summer.

These soils have potential as wetland and woodland wildlife habitats for migratory waterfowl, white-tailed deer, elk, black bear, forest grouse, and songbirds.

The seasonal high water table and annual flooding in unprotected areas are limitations in the development of buildings and the construction and installation of sanitary facilities and filter fields. Capability subclass IIIw.

43-Moctileme silt loam. This level to nearly level soil is very deep and somewhat poorly drained. It is on low terraces at elevations of 2,300 to 2,800 feet. It formed in alluvium and volcanic ash. This soil supports a grand fir-pachistima plant community. The average annual precipitation is about 27 inches, including 3 to 5 feet of snow. Average annual air temperature is about 44 degrees F.

Included with this soil in mapping are small areas of Lovell silt loam and Latahco silt loam.

This soil has moderately slow permeability. Effective rooting depth is 60 inches, and available water capacity is 10 to 13 inches. This soil has a seasonal high water table at a depth of 3 to 4 feet below the surface in most years from February to May. It is frequently flooded for brief periods from February to April. Surface runoff is slow,, and the hazard of erosion is slight. Channelization, or gully erosion, can result from flooding.

In a typical profile the surface layer is light brownish gray, slightly acid silt loam about 12 inches thick. The subsurface layer is light gray, neutral very fine sandy loam about 25 inches thick. The subsoil is mottled, very pale brown, neutral silty clay loam to a depth of 60 inches or more.

Most areas of this soil are in cultivated crops. However, in the lowlands close to the mountains, a larger acreage is in brush and timber. Adequate drainage for grain production is difficult to achieve because of flooding, wetness, and lack of suitable outlets. Small grain and hay or pasture are common crops, but some areas are used for grass seed. Legumes are mostly clovers. This soil is suited to a continuous cropping system, and production is good when crops are adequately fertilized with nitrogen, sulfur, and occasional phosphorus. In places, subsurface drainage and land smoothing are needed to correct seepage and to improve surface water removal. Stubble utilization and continuous cropping keep soil losses to a minimum.

This Moctileme soil is suited to the production of grand fir, Douglas-fir, ponderosa pine, western larch, lodgepole pine, and western white pine. It is capable of producing about 9,000 cubic feet per acre 0.6 inch and more in diameter or 17,900 board feet (Scribner rule) of merchantable timber 12.6 inches and more in diameter from an unmanaged stand of 80 year old trees. The seasonal high water table and flooding restrict the use of this soil for timber production. Trees can be harvested by conventional methods, but these methods can be restricted during winter and spring. Carefully managed reforestation after harvest reduces plant competition of undesirable understory plants.

This soil has potential for grazing where the understory vegetation is opened. Livestock naturally concentrate on this soil because of the extended green feed period and the proximity of this soil to water. Vegetation generally reverts to Canada bluegrass, Kentucky bluegrass, and shrubs when the timber is removed because of the increased grazing pressure. These sod-forming grasses and shrubs can severely inhibit natural regeneration of trees.

This soil has potential as woodland wildlife habitat for white-tailed deer, elk, black bear, forest grouse, and songbirds. Some upland game birds are suited to areas of grain crops.

Flooding and the seasonal high water table are limitations for homesite development and installation and use of most sanitary facilities. Road construction is limited by the hazard of flooding, potential frost action, a seasonal high water table, and the low strength of the soil.

Flooding and wetness are limitations for recreational development. Capability subclass IV w.

44-Naff-Palouse silt loams, 7 to 25 percent slopes. These rolling to hilly soils are on loess hills at elevations of about 2,125 to 3,200 feet. The average annual precipitation is about 20 inches, and the frost-free season is 100 to 150 clays_ Average annual air temperature is about 47 degrees F. This map unit is about 45 percent Naff silt loam and about 30 percent Palouse silt loam. These soils are so intermingled that they are not shown separately on the soil map.

Included with these soils in mapping are Tilma silt loam, Thatuna silt loam, and Garfield silty clay loam. These included soils make up 25 percent of the map unit.

The Naff soil is *very* deep and well drained. It formed in loess. Permeability is moderately slow. Effective rooting depth is 60 inches, and available water capacity is 11 to 12 inches. Surface runoff is rapid, and the hazard of erosion is high.

In a typical profile of the Naff soil the surface layer is dark grayish brown and brown, slightly acid and medium acid silt loam about 13 inches thick. The subsoil is pale brown and light yellowish brown, slightly acid and neutral silt loam and silty clay loam to a depth of 60 inches.

The Palouse soil is very deep and well drained. It formed in loess. Permeability is moderate. Effective rooting depth is 60 inches, and available water capacity is 11 to 13 inches. Surface runoff is rapid, and the hazard of erosion is high.

In a typical profile of the Palouse soil the surface layer is dark grayish brown and grayish brown, neutral silt loam about 24 inches thick. The subsoil is brown and yellowish brown, neutral silt loam to a depth of 60 inches or more. The soils in this unit are productive and extensive in the survey area. Excellent crop yields can be expected under good management. An adequate conservation program can be achieved with a continuous cropping system, such as small grain and peas, used with minimum tillage and crop residue. Applications of nitrogen, sulfur, and occasional phosphorus fertilizers are needed in all cropping systems.

Grassed waterways are needed to prevent gullies in drainageways where runoff from adjacent hills is significant. Other desirable practices for erosion control are contour farming, divided slope farming, diversion terraces, and field stripcropping. Legume-grass crops are also suitable and can be used on the steeper slopes for erosion control.

The soils of this unit have potential as openland or rangeland wildlife habitat. Some upland game species are suitable in areas of grain crops if cover is available or provided. Trees planted for windbreaks, such as green ash, Russian-olive, and Douglas-fir, serve also as shelter for such wildlife species as ring-necked pheasant, Hungarian partridge, and cottontail. To encourage larger populations of game birds and provide needed cover and nesting areas, shrub hedgerows can be established along fence lines and roadsides. Protected strip plantings of grain also provide additional food.

The moderately slow permeability of the Naff soil and the slope are limitations for homesite development and installation of sanitary facilities. The Palouse soil is suited to septic tank absorption fields except in areas where slopes are more than 15 percent. The high potential frost action, slope, and high shrink-swell potential of the Naff soil are limitations in the construction of roads and dwellings. These limitations generally can be overcome by modifying the design of roads and dwellings. Capability subclass IIIe.

45-Naff-Thatuna silt loams, 7 to 25 percent slopes. These rolling to hilly soils are on loess hills at elevations of 2,400 to 3,200 feet. The average annual precipitation is about 20 inches, and the frost-free season is 140 to 160 days. Average annual air temperature is about 47 degrees F. This map unit is about 50 percent Naff silt loam and about 30 percent Thatuna silt loam. These soils are so intricately mixed that they are not shown separately on the soil map.

Included with these soils in mapping are Palouse silt loam, Tilma silt loam, Garfield silty clay loam, and severely eroded areas of Naff and Thatuna soils. These included soils make up 20 percent of the map unit.

The Naff soil is very deep and well drained. It formed in loess. Permeability is moderately slow. Effective rooting depth is 60 inches, and available water capacity is 11 to 12 inches. Surface runoff is rapid, and the hazard of erosion is high.

In a typical profile the surface layer is dark grayish brown and brown, slightly acid and medium acid silt loam about 18 inches thick. The subsoil is pale brown and light yellowish brown, slightly acid and neutral silt loam and silty clay loam to a depth of 60 inches.

The Thatuna soil is very deep and moderately well drained. It formed in loess. Permeability is slow. Effective rooting depth is 60 inches, and available water capacity is 11 to 13 inches. Surface runoff is rapid, and the hazard of erosion is high. A perched water table is at a depth of 36 to 48 inches from February to April.

In a typical profile the surface layer is dark grayish brown, neutral silt loam about 19 inches thick. The subsoil is brown, slightly acid silt loam about 8 inches thick. Below this is a buried subsurface layer that is pale brown and very pale brown, slightly acid silt loam about 10 inches thick. The buried subsoil is light yellowish brown and yellowish brown, slightly acid and neutral silt loam and silty clay loam to a depth of 60 inches or more.

Most areas of these soils are in cultivated crops. The major crops are wheat, barley, lentils, peas, grass for seed, hay, and pasture.

A conservation program can be achieved by continuous cropping of small grain and peas and the use of minimum tillage and stubble mulching. The eroded ridges need to be seeded to sod crops in most years to reduce soil losses.

Contour farming, divided slope farming, field stripcropping, and diversion terraces are desirable to help control runoff and subsequent erosion. Grassed waterways are needed in drainageways where runoff concentrates and gullies form. Applications of nitrogen and sulfur are needed in all cropping systems, and phosphorus is needed on the eroded ridges.

The soils of this unit have potential as openland and rangeland wildlife habitat. Upland game birds are suitable on the cultivated soils. To encourage larger populations of these birds and to provide needed cover and nesting areas, shrub hedgerows can be established along fence lines and roadsides. Protected strip plantings of grain also provide additional food and some cover.

The moderately slow permeability of the Naff soil, the slow permeability and perched water table in the Thatuna soil, and the slope are limitations for installation of sanitary facilities. The perched water table in the Thatuna soil can also cause lateral movement of septic tank effluent, resulting in contamination of nearby streams. Community sewage systems are needed. The moderate shrink-swell potential, a high frost action potential, and slope limit dwellings and roads. These limitations can be offset by modifying the design of roads and dwellings. Capability subclass IIIe.

46-Naff-Tilma silt loams, 7 to 25 percent slopes. These rolling to hilly soils are on loess hills at elevations of 2,400 to 3,200 feet. The average annual precipitation is about 20 inches, and the frost-free season is 140 to 160 days. Average annual air temperature is about 47 degrees F. This map unit is about 55 percent Naff silt loam and about 30 percent Tilma silt loam. These soils are so intermingled that they are not shown separately on the soil map.

Included with these soils in mapping are Palouse silt loam, Thatuna silt loam, Garfield silty clay loam, and severely eroded areas of Naff and Tilma soils. Also included in places are eroded ridges and knobs. These included soils make up 15 percent of the map unit.

The Naff soil is very deep and well drained. It formed in loess. Permeability is moderately slow. Effective rooting depth is 60 inches, and available water capacity is 11 to 12 inches. Surface runoff is rapid, and the hazard of erosion is high.

In a typical profile of the Naff soil the surface layer is dark grayish brown and brown, slightly acid and medium acid silt loam about 18 inches thick. The subsoil is pale brown and light yellowish brown, slightly acid and neutral heavy silt loam and silty clay loam to a depth of 60 inches.

The Tilma soil is very deep and moderately well drained. It formed in loess. Permeability is slow. Effective rooting depth is 60 inches, and available water capacity is 10 to 11 inches. A perched water table is at a depth of 18 to 30 inches from November to April. Surface runoff is rapid, and the hazard of erosion is high.

In a typical profile of the Tilma soil the surface layer is dark grayish brown, slightly acid and medium acid silt loam about 14 inches thick. The subsoil is grayish brown, slightly acid silt loam about 6 inches thick. Below this is a buried subsurface layer that is pale brown and light gray, slightly acid silt loam about 4 inches thick. The buried subsoil is brown and light yellowish brown, medium acid to neutral silty clay and silty clay loam to a depth of 60 inches.

Most areas of these soils are in cultivated crops. The major crops are wheat, barley, lentils, peas, grass for seed, hay, and pasture. A silty clay subsoil in the Tilma soil and the included eroded areas affect farming in this unit. The different moisture stresses of these included areas is apparent in peas in midsummer.

A conservation program can be achieved by continuous cropping of small grain and peas and the use of minimum tillage and mulching stubble. The eroded ridges need to be seeded to sod crops. Other desirable practices for control of runoff and erosion are contour farming, divided slope farming, field stripcropping, and diversion terraces. Legumes and grasses are suitable for these soils and are especially helpful in reducing soil erosion on steeper slopes. Grassed waterways are needed in drainageways where concentration of runoff can cause gullies to form. Application of nitrogen, phosphorus, and sulfur generally are needed in all cropping systems.

The soils in this unit are suited to openland or rangeland wildlife habitat. Upland game birds are suited to cultivated areas. To encourage larger populations of these birds and to provide needed cover and nesting areas, shrub hedgerows can be established along fence lines and roadsides. Protected strip plantings of grain also provide additional food and some cover.

The slopes, the moderately slow permeability of the Naff soil, and the slow permeability and perched water table of the Tilma soil are limitations for development of homesites and installation of sanitary facilities. The perched water table in the Tilma soil can cause lateral movement of effluent from septic tank absorption fields, thus contaminating nearby streams. Community sewage systems are needed. The shrink-swell potential, the slope, and potential frost action are limitations in the construction of dwellings and roads. These limitations can be offset by modifying the design of dwellings and roads. Capability subclass IIIe.

47-Nakarna association, steep. This map unit consists of steep and very steep soils on mountain slopes at elevations of about 2,800 to 5,000 feet. The average annual precipitation is about 35 inches, including 5 to 8 feet of snow. Average annual air temperature is about 39 degrees F. This map unit is about 60 percent Nakarna silt loam, 5 to 35 percent slopes, and 20 percent Nakarna silt loam, 35 to 65 percent slopes. Both soils support a western hemlock-pachistima plant community.

Included with these soils in mapping are areas of Helmer silt loam, 3 to 40 percent slopes. This included soil makes up about 20 percent of the map unit.

The Nakarna soil is very deep and well drained. It formed in residuum and colluvium derived from schist with a mantle of volcanic ash and loess.

Permeability is moderate. Effective rooting depth is 60 inches, and available water capacity is 5 to 8 inches. Surface runoff is rapid, and the hazard of erosion is high on the 5 to 35 percent slopes. Surface runoff is very rapid and the hazard of erosion is very high on the 35 to 65 percent slopes.

In a typical profile the surface is covered by about 2.5 inches of needles and twigs. The upper 15 inches of the subsoil is yellowish brown and light yellowish brown, strongly acid to slightly acid silt loam, and the lower 19 inches is very pale brown, slightly acid fine sandy loam. The substratum is very pale brown, slightly acid gravelly fine sandy loam and very gravelly sandy loam to a depth of 60 inches.

The soils in this unit are not suited to cultivated crops. Most areas are in woodland and are used for timber production, watershed, and wildlife habitat.

The Nakarna soils are suitable for the production of western hemlock, western redcedar, western white pine, grand fir, Douglas-fir, lodgepole pine, and western larch. They are capable of producing about 10,350 cubic feet per acre 0.6 inch and more in diameter or 34,600 board feet per acre (Scribner rule) of merchantable timber 12.6 inches in diameter or more from an unmanaged stand of 80 year old trees. The high hazard of erosion on Nakarna silt loam, 5 to 35 percent slopes, and very steep slopes and the very high hazard of erosion on Nakarna silt loam, 35 to 65 percent slopes, are limitations for timber production. Care must be exercised in the selection of landings and skid trails to minimize soil losses. Logging roads must be designed to maintain relatively low slope gradients to keep soil losses at a minimum, to prevent soil slumps along unsupported cut slopes, and to maintain the watershed potential. The main concern in meeting this goal is careful management of the timber resource and understory vegetation.

The Nakarna soils have potential for grazing where the tree canopy is opened by fire or logging. Seeding disturbed areas of these soils to adapted grasses increases forage production. Important forage plants are seeded grasses, elk sedge, willow, mountain maple, and red-stem ceanothus. Management of vegetation should be designed to protect timber regeneration and to insure adequate litter for soil protection.

These soils produce forage for livestock and big game animals for 5 to 10 years following opening of the canopy. During this period, the total annual production varies from about 2,500 pounds of air-dry forage per acre to less than 300 pounds per acre as the canopy closes.

The Nakarna soils provide woodland wildlife habitat for white-tailed deer, elk, black bear, chipmunks, squirrels, and forest grouse.

The slope and frost action potential are limitations in the construction of homes, cabins, and roads. The Nakarna soils are rarely used for homesites because of the slope and inaccessibility.

The steep and very steep slopes are limitations for trails and camp areas. Nakarna silt loam, 5 to 35 percent slopes, in capability subclass VIe; Nakarna silt loam, 35 to 65 percent slopes, in capability subclass VIIe.

48-Nakarna association, very steep. This map unit consists mostly of very steep soils on mountains at elevations of about 2,800 to 5,000 feet. It is about 70 percent Nakarna silt loam, 35 to 65 percent slopes, and 30 percent Nakarna silt loam, 5 to 35 percent slopes. Both soils support a western hemlock-pachistima plant community.

The Nakarna soils are very deep and well drained. They formed in residuum and colluvium derived from schist with a mantle of volcanic ash and loess. Permeability is moderate. Effective rooting depth is 60 inches, and available water capacity is 7 to 8 inches. Surface runoff is very rapid on the 35 to 65 percent slopes and rapid on the 5 to 35 percent slopes. The hazard of erosion is very high on the 35 to 65 percent slopes and high on the 5 to 35 percent slopes. The average annual precipitation is about 35 inches, including 5 to 8 feet of snow. Average annual air temperature is about 39 degrees F.

In a typical profile the surface is covered by about 2.5 inches of needles and twigs. The upper 15 inches of the subsoil is yellowish brown and light yellowish brown, strongly acid to slightly acid silt loam, and the lower 19 inches is very pale brown, slightly acid fine sandy loam. The substratum is very pale brown, slightly acid gravelly fine sandy loam and very gravelly sandy loam to a depth of 60 inches or more.

Most areas of these soils are in woodland and are used for timber production, watershed, and wildlife habitat.

The Nakarna soils are suited to the production of western hemlock, western redcedar, western white pine, grand fir, Douglas-fir, lodgepole pine, and western larch. They are capable of producing about 10,350 cubic feet per acre 0.6 inch and more in diameter or 34,600 board feet per acre (Scribner rule) of merchantable timber 12.6 inches in diameter or more from an unmanaged stand of 80 year old trees.

Very steep slopes and the very high hazard of erosion are limitations for timber production on Nakarna silt loam, 35 to 65 percent slopes. The hazard of erosion is very high, and equipment limitations are severe. Care must be taken in the placement of roads so that they conform to the shape and contour of the slope. Sedimentation can be expected from roads, skid trails, and other disturbed areas when logging. Cut slopes cave; therefore, deep cuts need to be avoided. Special logging methods that cause minimum soil disturbance are needed. Management of steep slopes is needed to keep soil losses to a minimum, thus maintaining the watershed potential of these soils.

These soils have limited potential for grazing where the tree canopy is opened by fire or logging. Seeding disturbed areas of these soils to adapted grasses increases vegetation cover. Important forage plants are seeded grasses, elk sedge, willow, mountain maple, and red-stem ceanothus. Management of vegetation should be designed to protect timber regeneration, to provide good vegetation cover, and to insure adequate litter for soil protection.

These soils produce forage for livestock and big game animals for 5 to 10 years following opening of the canopy. During this period, the total annual production varies from about 2,500 pounds of air-dry forage per acre to less than 300 pounds per acre as the canopy closes. Steep slopes limit livestock movement and forage accessibility.

The Nakarna soils have potential as woodland wildlife habitat for white-tailed deer, elk, black bear, chipmunks, squirrels, and forest grouse.

Very steep slopes and frost action potential are limitations in the construction of homes, cabins, and roads. These soils are used rarely for homesites because of the slopes and inaccessibility.

Very steep slopes limit the use of these soils for trails and camp areas. Nakarna silt loam, 35 to 65 percent slopes, in capability subclass VIIe; Nakarna silt loam, 5 to 35 percent slopes, in capability subclass VIe.

49-Palouse silt loam, 3 to 7 percent slopes. This undulating to rolling soil is very deep and well drained. It is on loess hills at elevations of 2,150 to 2,800 feet. It formed in loess and a small amount of volcanic ash. The average annual precipitation is about 20 inches. Average annual air temperature is about 47 degrees F.

Included with this soil in mapping are small areas of Thatuna silt loam, 3 to 7 percent slopes. Also included are small areas of Naff silt loam and Tilma silt loam, which have slopes of 7 to 25 percent.

This soil has moderate permeability. Effective rooting depth is 60 inches or more, and available water capacity is 11 to 13 inches. Surface runoff is medium, and the hazard of erosion is moderate.

In a typical profile the surface layer is Clark grayish brown, neutral silt loam about 17 inches thick. The subsoil is grayish brown, brown, and yellowish brown, neutral silt loam to a depth of more than 60 inches.

Almost all areas of this soil are in cultivated crops and are productive. Continuous cropping of grain in various rotations with either peas or lentils are the usual crop rotations.

Minimum tillage and utilizing crop residue use are essential on this soil for erosion control. Other desirable practices for erosion control are contour farming, divided slope farming, and field stripcropping. Application of nitrogen, sulfur, and occasional phosphorus are needed for sustained production in all cropping systems. Chemical weed control is beneficial to crop yields. Grassed waterways are needed to help prevent the formation of gullies in drainageways where runoff from adjacent hills is significant.

This soil has potential for openland and rangeland wildlife habitats. Some upland bird species are suitable in grain crop areas if additional cover is provided. Trees planted for windbreaks, such as green ash, Russian olive, and Douglas-fir, provide shelter for ring-necked pheasant, Hungarian partridge, and cottontail.

The low strength and the potential frost action if footings are not placed below the frost penetration depth are limitations in the construction of roads and buildings. These limitations can be offset by modifying designs. Capability subclass IIe.

50-Palouse silt loam, 7 to 25 percent slopes. This rolling to hilly soil is very deep and well drained. It is on loess hills at elevations of 2,150 to 3,200 feet. It formed in loess and a small amount of volcanic ash in the upper part. The average annual precipitation is about 20 inches. Average annual air temperature is about 47 degrees F.

Included with this soil in mapping are areas of Naff silt loam, Thatuna silt loam and Tilma silt loam. These soils have slopes of 7 to 25 percent. Also included are small areas of Palouse silt loam, 3 to 7 percent slopes. The included soils each make up as much as 10 percent of the map unit.

This soil has moderate permeability. Effective rooting depth is 60 inches, and available water capacity is 11 to 13 inches. Content of organic matter in the surface layer is high. Surface runoff is rapid, and the hazard of erosion is high.

In a typical profile the surface layer is dark grayish brown, neutral silt loam about 17 inches thick. The subsoil is grayish brown, brown, and yellowish brown, neutral silt loam to a depth of more than 60 inches.

Almost all areas of this soil are in cultivated crops and are used for small grain, peas, lentils, pasture, and grass seed.

This soil is productive and extensive in the survey area. It produces excellent crop yields under good management. An adequate conservation program can be achieved with a continuous cropping system such as small grain in rotation with peas. Minimum tillage and utilizing crop residue help to control erosion. Grassed waterways are needed to help prevent the formation of gullies in drainageways when runoff from adjacent hills is significant. Other desirable practices for erosion, control are contour farming, divided slope farming, diversion terraces, and field stripcropping. Legume-grass crops are also suitable and are effective on the steeper slopes for erosion control. Applications of nitrogen, sulfur, and occasional phosphorus are needed in all cropping systems.

This soil has potential as openland and rangeland wildlife habitats. Some upland bird species are suitable in grain crop areas if some additional cover is provided. Trees planted for windbreaks, such as green ash, Russian-olive, and Douglas-fir, serve also as shelter for such wildlife species as ring-necked pheasant, Hungarian partridge, and cottontail.

Slope, low strength of this soil, and potential frost damage if footings are not placed below the frost penetration depth are limitations in the construction of roads and buildings. These limitations can be offset by modifying the designs of buildings and roads. Slope is a limitation in the construction and use of septic tank absorption fields. Capability subclass IIIe.

51-Pokey association. This map unit consists of level and nearly level soils on low stream terraces and flood plains. It is at elevations of 2,600 to 2,900 feet. It is about 60 percent Pokey fine sandy loam on low terraces and 15 percent Pokey loam on the flood plains. These soils have slopes of 0 to 2 percent.

Included with these soils in mapping are areas of Potlatch silt loam and Aquic Xerofluvents. These soils have slopes of 0 to 2 percent. Also included are areas of strip mines. The included soils make up about 25 percent of the map unit.

The Pokey soils are very deep and very poorly drained. They formed in alluvium derived mainly from schist. The average annual precipitation is about 30 inches. Average annual air temperature is 41 degrees F.

In a typical profile Pokey fine sandy loam has a surface layer of mottled, grayish brown, neutral fine sandy loam about 17 inches thick. The upper part of the substratum is mottled, light brownish gray, neutral fine sandy loam about 7 inches thick. The lower part of the substratum is mottled, coarse sand and gravel to a depth of 60 inches or more. A typical profile of Pokey loam is similar to that of Pokey fine sandy loam, except the upper 9 inches of the surface layer is loam.

Pokey fine sand loam has moderately rapid permeability in the surface layer, and Pokey loam has moderate permeability in the surface layer. Both soils have very rapid permeability in the lower part of the substratum. The effective rooting depth is 60 inches or more, and the available water capacity is 4 to 6 inches. These soils have a high water table at a depth of 12 to 36 inches from February to June. They are frequently flooded for long periods in spring. Surface runoff is slow, and the hazard of erosion is slight. Channelization is likely during flooding.

These soils are used mainly for native pasture, wildlife habitat, and some woodland. They are seldom in cultivated crops. Vegetation consists of sedges, grasses, and water-tolerant forbs. Some trees and brush are along the edges of areas.

These soils are suited to the production of cottonwood trees. The hazard of flooding and a seasonal water table during winter and spring are the main limitations for timber production. Trees can be harvested by conventional methods, but these methods can be restricted during rainy periods.

When these soils are used for pasture they should be fenced to prevent livestock from entering nearby streams. Streambank protection is needed in places. Grasses, such as Garrison meadow foxtail and reed canarygrass, grow well in these soils.

These soils have potential as woodland and wetland wildlife habitats. Woodland areas are used by white-tailed deer, black bear, squirrels, chipmunks, grouse, and various songbirds. Wetland habitat is also used some by these animals but mostly by waterfowl.

The hazard of flooding, a seasonal high water table, and damage from potential frost action **are** limitations for roads, buildings, and sanitary facilities.

The construction of recreational facilities is limited by the hazard of flooding and by the seasonal high water table. Both soils in capability subclass IVw.

52-Porrett silt loam. This level and nearly level soil is very deep and very poorly drained. It is on alluvial bottom lands and in broad drainageways at elevations of 2,600 to 2,900 feet. It formed in loess and volcanic ash alluvium. Slopes are 0 to 2 percent. The average annual precipitation is about 30 inches, including 4 to 6 feet of snow. Average annual air temperature is about 42 degrees F.

Included with this soil in mapping are areas of Moctileme silt loam and Potlatch silt loam. These soils have slopes of 0 to 2 percent.

This soil has moderately slow permeability. Effective rooting depth **is** 60 inches, and available water capacity is 11 to 13 inches. This soil has a water table that fluctuates between the surface and a depth of 12 inches from April to June. It is frequently flooded for brief periods early in spring. Surface runoff is slow, and the hazard of erosion is slight.

In a typical profile the surface layer is mottled, gray, medium acid silt loam about 3 inches thick. The subsurface layer is mottled, light gray, very strongly acid to medium acid silt loam about 18 inches thick. The subsoil is mottled, light gray and yellowish gray, slightly acid and neutral silty clay loam to a depth of 60 inches.

This soil is used for hay and pasture.

The cold soil temperature and the seasonal high water table are limitations for cropland. Establishing improved domestic grasses on these meadow lands is sometimes feasible, but tillage must be confined to summer and seeding must be accomplished late in fall. Fertilizer programs need to be based on soil tests. Grasses are commonly expected to respond to nitrogen fertilizer, but applications need to be determined locally.

This Porrett soil has potential as wetland wildlife habitat and some woodland wildlife habitat. Wetland areas are used by waterfowl and by some woodland species such as white-tailed deer, forest grouse, squirrels, and songbirds.

Potential flooding and the seasonal high water table are limitations for roads, buildings, or sanitary facilities. Damage from potential frost action and low strength are limitations in the construction of buildings and roads. Drainage design is difficult but is needed to overcome flooding and sloughing of cut banks. Capability subclass I Vw.

53-Potlatch-Pokey association. This map unit consists of level to nearly level soils on alluvial fans and stream terraces at elevations of 2,700 to 2,900 feet. It is about 70 percent Potlatch silt loam, 0 to 2 percent slopes, and 25 percent Pokey fine sandy loam, 0 to 2 percent slopes. The Potlatch soil is in swales, in basins along steams, and in depressions on the alluvial fans. Vegetation consists of mostly sedges, rushes, and tuffed hairgrass. The Pokey soil is on the low stream terraces. Both soils support a cottonwood plant community.

Included with these soils in mapping are areas of strip mines. These included areas make up about 5 percent of the map unit.

The Potlatch soil is very deep and poorly drained. It formed in mixed alluvium. The average annual precipitation is about 30 inches, including 3 to 5 feet of snow. Average annual air temperature is about 42 degrees F.

Permeability is very slow. Effective rooting depth is 60 inches, and available water capacity is 10 to 12 inches. This soil has a seasonal high water table at a depth of 18 to 42 inches from February to July. It is frequently flooded for very long periods from February to May. Surface runoff is slow, and the hazard of erosion is slight. Channeling is likely during flooding.

In a typical profile of the Potlatch soil the surface layer is *very* dark grayish brown, strongly acid silt loam about 5 inches thick. The subsoil is mottled; dark grayish brown, medium acid silty clay loam about 9 inches thick. Below this is a buried subsurface layer that is mottled, light gray, medium acid silt about 5 inches thick. The buried subsoil is mottled, light brownish gray, neutral silty clay loam about 21 inches thick. The substratum is mottled, yellowish reel, light gray, and light olive gray, strongly acid to neutral very fine sandy loam to a depth of 60 inches or more.

The Pokey soil is very deep and very poorly drained. It formed in alluvium derived mainly from schist over coarse sand and gravel. Permeability is moderately rapid. Effective rooting depth is 60 inches or more, and available water capacity is 4 to 6 inches. This soil has a seasonal high water table at a depth of 12 to 36 inches from February to June. It is frequently flooded for long periods during spring. Surface runoff is slow, and the hazard of erosion is slight. Channelization is likely during flooding. The average annual precipitation is about 30 inches. Average annual air temperature is about 41 degrees F.

In a typical profile the surface layer is mottled, grayish brown, neutral fine sandy loam about 17 inches thick. The upper part of the substratum is mottled, light brownish gray, neutral fine sandy loam about 7 inches thick. The lower part is mottled, coarse sand and gravel to a depth of 60 inches or more.

The soils in this unit are used mainly for hay, pasture, wildlife habitat, and some woodland. Vegetation on both soils consists of sedges, grasses, and water-tolerant forbs. Some trees and brush have encroached along the edges of the wet meadows.

The soils are very poorly suited to cultivation because of the cold soil temperature and seasonal high water table that adversely affect tillage and crop production. These soils are suited to hay and pasture.

The Pokey soil in this unit is suited to the production of cottonwood trees. The hazard of flooding and the seasonal high water table during winter and spring are limitations for timber production. Trees can be harvested by conventional methods, but these methods can be restricted during winter and spring.

These soils have potential for grazing. They are natural concentration areas for livestock because of their proximity to water and the extended green feed period. Under heavy grazing pressure, the understory vegetation reverts to sod-forming bluegrasses and brush. If grazing is properly managed, vegetation composition can be manipulated to produce a sustained quantity and quality of forage well into summer.

These soils have potential as wetland wildlife habitat and woodland wildlife habitat. Wetland areas are used by waterfowl woodland species such as white-tailed deer, black bear, and songbirds.

The soils in this map unit are not suited to building sites, septic tank absorption fields, and roads because of the hazard of flooding and the seasonal high water table. Flooding and the high water table severely limit recreational facilities. Both soils in capability subclass IVw.

54-Pywell muck. This level and nearly level soil is very deep and very poorly drained. It is in depressions on flood plains at elevations of 2,120 to 2,150 feet. It formed in organic materials derived mainly from herbaceous plants but includes some material derived from trees and shrubs. The average annual precipitation is about 25 inches. Average annual air temperature is about 43 degrees F.

Included with this soil in mapping are areas of DeVoignes silt loam, Miesen silt loam, and Ramsdell silt loam. These included soils make up about 20 percent of the map unit.

This soil has moderate permeability. Effective rooting depth is 60 inches, and available water capacity is very high. This soil has a seasonal high water table at a depth of 24 inches in spring. It is subject to flooding if it is not protected by dikes or levees. Surface runoff is very slow, and the hazard of erosion is slight. Channelization is possible in places during flooding.

In a typical profile the surface layer is stratified, highly decomposed dark reddish brown, very strongly acid, organic material about 12 inches thick. The subsurface layer is highly decomposed, grayish brown and dark reddish brown, very strongly acid, organic material about 35 inches thick. It has a few, mixed, very thin layers of mineral soil throughout. The next layer is highly decomposed, grayish brown, very strongly acid, organic material to a depth of 60 inches or more.

If this soil is drained, it is used for some small grain, hay, pasture, and grass seed. Vegetation consists of cattails, sedges, reeds, and water-tolerant grasses with scattered areas of willow, alder, cottonwood, western redcedar, and Engelmann spruce.

Tillage of this soil and choice of crops are influenced by the seasonal high water table. Spring seeded crops are most reliable. Fertilization is essential for high production. Applications of nitrogen and phosphorus fertilizers generally are needed. Areas of this soil have been diked against overflow from the river but flooding occurs to varying degrees.

Land smoothing and maintenance of the drainage system are needed in areas where this soil is drained.

If undrained and unprotected, the soil is wet late into the season. Grazing is limited to summer and early in fall because of wetness. Forage plants consist of sedges, quackgrass, and reed canarygrass. Management of vegetation should be designed to maintain production of quackgrass and canarygrass. The annual production in these areas varies from 4,000 to 6,000 pound of air-dry herbage per acre.

This Pywell soil is suited to wetland and rangeland wildlife habitats. Migratory waterfowl are suited to areas of this soil which are also used by white-tailed deer, forest grouse, squirrels, and songbirds.

This soil is not suited to building sites. Sanitary facilities do not function properly because of the hazard of flooding, the seasonal high water table, and excess humus. Construction of any dwellings or roads is hampered by flooding, excess humus, the seasonal high water table, and a high potential frost action.

The hazard of flooding, seasonal high water table, dust, and excess humus limit recreational facilities. Capability subclass IVw.

55-Ramsdell-DeVoignes association. This map unit consists of level to nearly level soils in basins and on low terraces on flood plains. It is at elevations of about 2,140 to 2,200 feet. This map unit is about 60 percent Ramsdell silt loam and about 35 percent DeVoignes silt loam. These soils have slopes of 0 to 2 percent. The Ramsdell soil is on nearly level low terraces, and the DeVoignes soil is in level basins and depressions.

Included with these soils in mapping are small areas of Miesen silt loam and Pywell muck. These included soils make up about 5 percent of the map unit.

The Ramsdell soil is very deep and very poorly drained. It formed in alluvium. Permeability is moderate. Effective rooting depth is 60 inches, and available water capacity is 10 to 11 inches. This soil has a seasonal high water table at a depth of 6 to 24 inches from February to April. It is frequently flooded in spring for long periods unless it is protected by levees. Surface runoff is slow, and the hazard of erosion is slight. Channelization is likely in unprotected areas during annual overflow. The average annual precipitation is about 29 inches, including 3 to 5 feet of snow. Average annual air temperature is about 44 degrees F.

In a typical profile of the Ramsdell soil the surface layer is light gray, medium acid silt loam about 3 inches thick. The subsoil is mottled, light gray, slightly acid and medium acid very fine sandy loam and silt loam about 27 inches thick. The substratum is mottled, light gray, medium acid silt loam to a depth of 60 inches or more.

The DeVoignes soil is very deep and very poorly drained. It formed in stratified alluvium and organic materials. Permeability is slow. Effective rooting depth is 60 inches or more, and available water capacity is 10 to 13 inches. Surface runoff is very slow, and the hazard of erosion is slight. This soil has a seasonal high water table at a depth of 0 to 24 inches from April to July. It is subject to annual flooding in spring unless it is protected by levees. The average annual precipitation is about 25 inches. Average annual air temperature is about 44 degrees F.

In a typical profile of the DeVoignes soil the surface layer is pale brown very strongly acid silt loam about 9 inches thick. The next 15 inches is thinly stratified, mot tled, grayish brown and gray peat, silt loam, and silty clay loam. The substratum is mottled, light brownish gray, very strongly acid silty clay loam to a depth of 60 inches. Wide cracks, 1/2 inch to 2 inches wide, develop from the surface to below a depth of 40 inches when the soil is dry.

The soils in this map unit are important for cropland in the St. Joe River Valley flood plains. They are used mainly for hay and pasture. Some small grain and grass seed are grown in areas that have better drainage and protection from flooding.

Although the soils of this unit can be used and managed separately, their limitations are the same and must be corrected if improved crops are to be grown. Drainage and flood protection must be provided. Shallow drain ditches are adequate to lower the seasonal high water table. Smoothing to remove depressions is also beneficial. Water-tolerant grasses and clover can be grown. Applications of nitrogen, phosphorus, and occasional sulfur fertilizers are needed in all cropping systems.

The Ramsde1l soil is suited to the production of cottonwood trees. The main limitations for this use are the hazard of flooding and the seasonal high water table. Trees can be harvested by conventional methods, but these methods can he restricted during rainy periods.

The soils of this unit have potential for grazing. They are natural concentration areas for livestock because of their proximity to water and the extended green feed period. Under heavy grazing pressure, the understory vegetation reverts to sod-forming bluegrasses and brush. If grazing is properly managed, vegetation composition can be manipulated to attain high production and quality forage well into summer.

These soils are not suited to buildings or roads, and most kinds of sanitary facilities will not function properly, because of the hazard of flooding and the seasonal high water table.

These soils have potential as wetland wildlife habitat. Migratory waterfowl are suited to these areas. The Ramsdell soil also has some potential as rangeland wildlife habitat. Both soils in capability subclass IVw.

56-Rock outcrop. This map unit consists of exposures of bare bedrock. Crevices in the rock contain some soil material. Areas are commonly small and are shown on the soil map by symbols, but some areas are large and outcrop is intermingled with small spots of soil. Most areas of this unit are on mountains and are associated with Ardenvoir, Huckleberry, Lacy, and Bobbitt soils. Capability subclass VIIIs.

57-Santa silt loam, 3 to 20 percent slopes. This undulating to hilly soil is very deep and moderately well drained. It is on loess hills at elevations of 2,300 to 3,000 feet. It formed in deep loess deposits with a minor influence from volcanic ash. This soil supports a grand fir-pachistima plant community. The average annual precipitation is about 27 inches. Average annual air temperature is about 43 degrees F.

Included with this soil in mapping are small areas of Porrett silt loam, 0 to 3 percent slopes, in drainageways.

This soil has very slow permeability. The very dense, buried subsoil causes a perched water table at a depth of 22 to 36 inches during spring. The effective rooting depth is 22 to 36 inches because of the very dense layer. Available water capacity is 4 to 8 inches. Surface runoff is rapid, and the hazard of erosion is high.

In a typical profile the surface layer is light brownish gray and light gray, medium acid silt loam about 9 inches thick. The subsoil is light gray, medium acid silt loam about 6 inches thick. Below this is a buried subsurface layer that is light gray, medium acid and strongly acid silt loam and silt about 19 inches thick. The buried subsoil is very dense and is yellowish brown and pale brown, strongly acid and medium acid, brittle silty clay loam to a depth of 60 inches.

Some areas of this soil are in cultivated crops, such as wheat, barley, oats, grass-legume, hay, pasture, or bluegrass seed. The bluegrass is effective in checking erosion on the steep slopes. The fragipan and perched water table limit the growth of the deeper-rooted plants. Conservation practices are needed to maintain fertility and minimize erosion. Cross-slope farming, minimum tillage, crop residue use, and cover crops help reduce erosion. Most crops respond to applications of nitrogen, phosphorus, sulfur, and potash fertilizers.

Most areas of this soil are in woodland. This soil is suited to the production of grand fir, Douglas-fir, ponderosa pine, western larch, lodgepole pine, and western white pine. It is capable of producing about 9,000 cubic feet per acre 0.6 inch and more in diameter or 17,900 board feet (Scribner rule) of merchantable timber 12.6 inches and more in diameter from an unmanaged stand of 80 year old trees. The very slow permeability, limited rooting depth, and perched water table during winter and spring restrict the use of this soil for timber production. Conventional logging methods are possible, except during rainy periods in winter and spring. Carefully managed reforestation after harvest reduces plant competition of undesirable understory plants.

This soil has potential for grazing where the canopy is opened by logging, fire, or some other disturbance. Seeding disturbed areas of this soil to adapted grasses increases forage production and helps protect the soil. Important forage plants are seeded grasses, elk sedge, serviceberry, red-stem ceanothus, and bluegrass. Management of vegetation should be designed to protect timber regeneration and to insure adequate litter for soil protection.

This soil produces forage for livestock and big game animals for 10 to 20 years following opening of the canopy. During this period, the total annual production varies from about 1,800 pounds of air-dry forage per acre to less than 200 pounds per acre as the canopy closes.

The Santa soil has potential as woodland wildlife habitat for white-tailed deer, elk, black bear, forest grouse, and songbirds. Cultivated areas have potential as openland wildlife habitat for upland game birds, such as ring-necked pheasant and Hungarian partridge. To encourage increased populations of these birds, shrub hedgerows can be established along fence lines, roadsides, and streambanks to provide needed cover and nesting areas. Protected strip plantings of grain also provide some cover and are good food sources.

The perched water table during winter and spring and the possibility of damage from frost action are limitations in the construction of buildings and roads. Septic tank absorption fields do not function properly because of the perched water table and slow permeability. Capability subclass IVe.

58-Santa silt loam, 20 to 35 percent slopes. This steep soil is very deep and moderately well drained. It is on loess hills at elevations of 2,300 to 3,000 feet. It formed in deep loess deposits with a minor influence from volcanic ash. This soil supports a grand fir-pachistima plant community. The average annual precipitation is about 27 inches. Average annual air temperature is about 43 degrees F.

Included with this soil in mapping are small areas of Porrett silt loam, 0 to 3 percent slopes, in drainageways.

Permeability is very slow. The very dense, buried subsoil causes a perched water table at a depth of 22 to 36 inches in spring. Effective rooting depth is 22 to 36 inches because of the very dense layer. Available water capacity is 4 to 8 inches. Surface runoff is very rapid, and the hazard of erosion is very high.

In a typical profile the surface layer is light brownish gray and light gray, medium acid silt loam about 9 inches thick. The subsoil is light gray, medium acid silt loam about 6 inches thick. Below this is a buried subsurface layer that is light gray, medium acid to strongly acid silt loam and silt about 19 inches thick. The buried subsoil is very dense and is yellowish brown and pale brown, strongly acid and medium acid, brittle silty clay loam to a depth of about 60 inches.

A small acreage of this soil is cultivated. Common crops are small grain, hay, pasture, or bluegrass seed. The bluegrass is effective in checking erosion on the steep slopes. The fragipan and perched water table limit growth of the deep-rooted plants. Cross-slope farming, conservation cropping systems, crop residue use, minimum tillage, and cover crops are needed to control erosion. Most crops respond to applications of nitrogen, sulfur, phosphorus, and potash fertilizers.

Most areas of this soil are in woodland. This soil is suited to the production of grand fir, Douglas-fir, ponderosa pine, western larch, lodgepole pine, and western white pine. It is capable of producing about 9,700 cubic feet per acre 0.6 inch and more in diameter or 17,900 board feet (Scribner rule) of merchantable timber 12.6 inches and more in diameter from an unmanaged stand of 80 year old trees. The very slow permeability, limited rooting depth, and a perched water table during wet periods in winter and spring restrict the use of this soil for timber production. Conventional logging methods are possible on this Santa soil except during rainy periods. Carefully managed reforestation after harvest reduces plant competition of undesirable understory plants.

This soil has potential for grazing where the canopy is opened by logging, fire, or some other disturbance. Seeding disturbed areas of this soil to adapted grasses increases forage production and helps protect the soil. Important forage plants are seeded grasses, elk sedge, serviceberry, red-stem ceanothus, and bluegrass. Management of vegetation should be designed to protect timber regeneration and to insure adequate litter for soil protection.

This soil produces forage for livestock and big game animals for 10 to 20 years following opening of the canopy. During this period, the total annual production varies from about 1,800 pounds of air-dry herbage per acre to less than 200 pounds per acre as the canopy closes.

The Santa soil is suited to woodland wildlife habitat for white-tailed deer, elk, black bear, forest grouse, and songbirds. Cultivated areas have potential openland wildlife habitat for upland game birds, such as ring-necked pheasant and Hungarian partridge. To increase populations of these birds and to provide needed cover and nesting areas, shrub hedgerows can be established along fence lines, roadsides, and streambanks. Protected strip plantings of grain also provide some cover and are good food sources.

Slope, the perched water table, and the potential frost action are limitations in the construction of buildings and roads. Recreational facilities are limited because of dust and slope. Capability subclass VIe.

59-Santa Variant silt loam, 5 to 20 percent slopes. This rolling to hilly soil is moderately deep and moderately well drained. It is on loess hills at elevations of 2,300 to 3,000 feet. It formed in loess over fractured basalt or metasedimentary bedrock. This soil supports a grand fir-pachistima plant community. The average annual precipitation is about 27 inches. Average annual air temperature is about 43 degrees F.

Included with this soil in mapping are small areas of Santa silt loam, 3 to 20 percent slopes.

This soil has very slow permeability. A perched water table is at a depth of 18 to 30 inches in spring. Effective rooting depth is 16 to 25 inches because of the very dense layer. Available water capacity is 3 to 5 inches. Surface runoff is rapid, and the hazard of erosion is high.

In a typical profile the surface layer is light brownish gray and light gray, medium acid silt loam about 9 inches thick. The subsoil is light gray, medium acid silt loam about 6 inches thick. Below this is a buried subsurface layer that is light gray, strongly acid silt loam about 8 inches thick. The buried subsoil is very dense and is yellowish brown, strongly acid, brittle silty clay loam about 13 inches thick. Fractured basalt is at a depth of about 36 inches.

Most areas of this soil are used for woodland. Small areas are in cultivated crops, such as wheat, barley, grass-legume hay, and pasture. Some bluegrass seed is also produced. The limited rooting zone, the perched water table, and depth to bedrock greatly restrict root growth of most plants.

This Santa Variant soil is suited to the production of grand fir, Douglas-fir, ponderosa pine, western larch, lodgepole pine, and western white pine. It is capable of producing about 7,750 cubic feet per acre 0.6 inch and more in diameter or 6,500 board feet (Scribner rule) of merchantable timber 12.6 inches and more in diameter from an unmanaged stand of 80 year old trees. The very slow permeability, the perched water table during winter and spring, limited rooting depth, and depth to bedrock restrict the use of this soil for timber production. Conventional logging methods can be used except during winter and spring. Carefully managed reforestation after harvest reduces plant competition of undesirable understory plants.

This soil has potential for grazing where the canopy is opened by logging, fire, or some other disturbance. Seeding disturbed areas of this soil to adapted grasses increases forage production and helps protect the soil. Important forage plants are seeded grasses, elk sedge, serviceberry, red-stem ceanothus, and bluegrass. Management of vegetation should be designed to protect timber regeneration and to insure adequate litter for soil protection.

This soil produces forage for livestock and big game animals for 10 to 20 years following opening of the canopy. During this period, the total annual production varies from about 1,800 pounds of air-dry forage per acre to less than 200 pounds per acre as the canopy closes.

This soil is suited to woodland wildlife habitat for white-tailed deer, elk, black bear, forest grouse, and songbirds. Cultivated areas have some potential as openland wildlife habitat for upland game birds, such as ring-necked pheasant and Hungarian partridge. To encourage increased populations of these birds and to provide needed cover and nesting areas, shrub hedgerows can be established along fence lines, roadsides, and streambanks. Protected strip plantings of grain also provide some cover and are good food sources.

The perched water table and depth to bedrock limit building development. Septic tank absorption fields do not function properly because of these limitations. The potential frost action and depth to bedrock are limitations in the construction of most roads. Capability subclass VIe.

60-Schumacher silt loam, 7 to 25 percent slopes. This rolling to hilly soil is deep and well drained. It is on mountain foot slopes at elevations of 2,400 to 3,500 feet. It formed in material derived from sandstone, quartzite, and slate with a mixture of loess. It supports an Idaho fescue-snowberry plant community. The average annual precipitation is about 20 inches. Average annual air temperature is about 47 degrees F.

Included with this soil in mapping are areas of Tekoa shaly loam, Naff silt loam, small areas of a soil that has shale at a depth of 10 to 20 inches, and small areas of Schumacher silt loam, 3 to 7 percent slopes.

This soil has moderately slow permeability. Effective rooting depth is more than 40 inches, and available water capacity is 6 to 7 inches. Surface runoff is rapid, and the hazard of erosion is high.

In a typical profile the surface layer is dark grayish brown, neutral silt loam about 12 inches thick. The subsoil is brown, yellowish brown, and light yellowish brown, neutral stony silty clay loam and gravelly clay loam about 28 inches thick. Weathered quartzite is at a depth of about 40 inches.

This Schumacher soil is used for range and for hay, pasture, and some small grain. Vegetation consists mainly of Idaho fescue, bluebunch wheatgrass, Sandberg bluegrass, snowberry, wild rose, forbs, annual grasses, and some scattered areas of ponderosa pine. The total annual production varies from 1,600 pounds of air-dry forage per acre to 1,000 pounds per acre.

Special designs in management of vegetation help increase the production of Idaho fescue, bluebunch wheatgrass, and Sandberg bluegrass. Controlling shrubs and proper grazing management help improve the range and maintain adequate plant cover.

A small acreage of this soil is in cultivated crops. Depth to bedrock and rock fragments in the soil limit productivity. This soil is very erodible. Hay and pasture are suited to long term stands. Applications of nitrogen and sulfur fertilizers are needed for good crop yields.

This soil has potential as openland and rangeland wildlife habitats. Populations of upland game birds can be increased in cultivated areas by planting shrub hedgerows along fence lines and roadsides for cover. Mule deer and rodent type animals use the rangeland areas.

Depth to bedrock and the slope are limitations in the construction of dwellings and roads. Septic tank absorption fields do not function properly because of these limitations. Slope is a limitation for recreational facilities. Capability subclass IVe.

61-Schumacher silt loam, 25 to 40 percent slopes. This steep soil is deep and well drained. It is on mountain foot slopes at elevations of 2,400 to 3,500 feet. It formed in material derived from sandstone, quartzite, and slate with a mixture of loess. It supports an Idaho fescue-snowberry plant community. Average annual air temperature is about 47 degrees F.

Included with this soil in mapping are areas of Tekoa shaly loam and Naff silt loam, small areas of a soil that has shale at a depth of 10 to 20 inches, and small areas of Schumacher silt loam, 7 to 25 percent slopes.

This soil has moderately slow permeability. Effective rooting depth is more than 40 inches, and available water capacity is 6 to 7 inches. Surface runoff is very rapid, and the hazard of erosion is very high.

In a typical profile the surface layer is dark grayish brown, neutral silt loam about 12 inches thick. The subsoil is brown, yellowish brown, and light yellowish brown, neutral stony silty clay loam and gravelly clay loam about 28 inches thick. Weathered quartzite is at a depth of about 40 inches.

This Schumacher soil is used for range. Vegetation consists mainly of Idaho fescue, bluebunch wheatgrass, Sandberg bluegrass, snowberry, wild rose, forbs, annual grasses and some scattered ponderosa pine. The total annual production of air-dry forage varies from 1,600 pounds per acre to 1,000 pounds per acre.

Special designs in management of vegetation help increase the production of Idaho fescue, bluebunch wheatgrass, and Sandberg bluegrass. Controlling shrubs and proper grazing management help improve the range and maintain adequate plant cover.

This soil has potential as rangeland wildlife habitat for mule deer and rodent type animals.

Depth to bedrock and the slope restrict homesite development and road construction. Septic tank absorption fields do not function properly because of these limitations. Roads need to be built to minimize soil losses and to protect the cut slopes from soil slippage during wet seasons. Installation of recreational facilities is severely limited by the slopes. Capability subclass VIe.

62-Setters silt loam, 3 to 20 percent slopes. This soil is very deep and moderately well drained. It is mainly on ridgetops of loess hills at elevations of 2,300 to 2,800 feet. This soil formed in loess. It supports a Douglas-fir-snowberry plant community. Average annual air temperature is about 44 degrees F.

Included with this soil in mapping are areas of Taney silt loam, Southwick silt loam, and Worley silt loam and severely eroded areas of Setters soil.

This soil has very slow permeability. Effective rooting depth is 60 inches, and available water capacity is 10 to 13 inches. The buried subsoil causes a perched water table at a depth of about 12 to 18 inches in winter and spring. Surface runoff is rapid, and the hazard of erosion is high.

In a typical profile the surface layer is brown, slightly acid and neutral silt loam about 12 inches thick. The upper part of the subsoil is pale brown, neutral silt loam about 6 inches thick. Below this is a buried subsurface layer that is very pale brown, neutral silt loam about 2 inches thick. The buried subsoil is light yellowish brown and yellowish brown, slightly acid and neutral silty clay to a depth of 60 inches.

Most areas of this Setters soil is in cultivated crops, such as wheat, barley, peas, lentils, grass seed, grass-legume hay, and pasture. A few areas are used for timber production and grazing.

The very slow permeability of this soil increases runoff potential and causes considerable soil loss during cropping. Continuous cropping, utilizing crop residue, and minimum tillage are adequate conservation practices in areas that have slopes of less than 8 percent. Extra protection from runoff is needed in areas that have slopes of more than 8 percent. Field strips, sod crops, and diversion and gradient terraces help to control runoff in the more sloping areas. Grassed waterways are needed where runoff water is significant in drainageways. Applications of nitrogen, sulfur, and occasional phosphorus fertilizers are needed in all cropping systems.

This soil is suited to the production of ponderosa pine and Douglas-fir. It is capable of producing about 4,100 cubic feet per acre 0.6 inch and more in diameter or 7,000 board feet (Scribner rule) of merchantable timber 11.6 inches and more in diameter from an unmanaged stand of 80 year old trees.

The very slow permeability, a perched water table, and the high hazard of erosion, restrict the use of this soil for timber production. Conventional logging methods can be used except during winter and spring. Carefully managed reforestation after harvest reduces plant competition of undesirable understory plants.

This soil has potential for grazing, especially where the canopy has been opened by logging or fire. Seeding disturbed areas of this soil to grasses increases forage production. Important forage plants are seeded grasses, elk sedge, bluebunch wheatgrass, bluegrass, American vetch, rose, and willow. A variety of shrubs can dominate the vegetation once the canopy is opened. Management of vegetation should be designed to protect timber regeneration and to increase production of elk sedge, Idaho fescue, and bluebunch wheatgrass.

This soil produces forage for livestock and big game animals continually under woodland management. If not managed, forage is produced for 20 to 30 years. The total annual production varies from 2,000 pounds of air-dry forage per acre to less than 200 pounds per acre. Grazing management is also important in plant composition and production of the understory vegetation.

The Setters soil has potential as woodland wildlife habitat. Upland game birds can be encouraged in cultivated areas where additional cover is provided. Such wildlife as deer, black bear, forest grouse, and songbirds use woodland areas.

The very slow permeability and a perched water table are limitations for development of homesites and installation of sanitary facilities. Construction of buildings and roads is limited by the low strength of the soil, the perched water table, and a high shrink-swell potential. Recreational facilities are limited by dust and slope. Capability subclass IVe.

63-Southwick silt loam, 3 to 12 percent slopes. This undulating to rolling soil is very deep and moderately well drained. It is on loess hills at elevations of 2,300 to 3,500 feet. This soil formed in loess. It supports a ponderosa pine-snowberry plant community. The average annual precipitation is about 23 inches, including about 4 feet of snow. Average annual air temperature is about 46 degrees F.

Included with this soil in mapping are small areas of Larkin silt loam and Taney silt loam. These soils have slopes of 3 to 12 percent.

This soil has slow permeability. Effective rooting depth is 60 inches, and available water capacity is 11 to 13 inches. A perched water table is at a depth of 36 to 42 inches in spring. Surface runoff is rapid, and the hazard of erosion is high.

In a typical profile the surface layer is dark grayish brown, medium acid silt loam about 18 inches thick. The subsoil is pale brown, medium acid silt loam about 6 inches thick. Below this is a buried subsurface layer that is very pale brown, yellowish brown, and pale brown, slightly acid silty clay loam to a depth of more than 60 inches.

Most areas of this soil are in cultivated crops. Common crops are small grain, peas, lentils, grass seed, hay, and pasture. Some timber is produced in areas of this soil.

This soil is important in farming. Under good management, it produces good yields of all adapted crops. Erosion is not difficult to control under continuous cropping if minimum tillage is used. Returning all crop residue is needed. If peas and lentils are in the cropping system, extra protection against runoff, such as divided slope farming, is needed in places. Grassed waterways are needed in drainageways where gully formation is a hazard. Also where erosion control is needed, the use of terraces and contour farming are desirable (fig. 6). Applications of nitrogen, sulfur, and occasional phosphorus fertilizers are needed in all cropping systems. Fertilizer applications can be based on soil tests, crop needs, and latest experiment station results. Chemical weed control is also beneficial to crop yields.

This Southwick soil is suited to the production of ponderosa pine. It is capable of producing about 7,000 cubic feet per acre 0.6 inch and more in diameter or 26,000 board feet (Scribner rule) of merchantable timber 11.6 inches and more in diameter from an unmanaged stand of 80 year old trees. The slow permeability and a perched water table during winter and spring restrict the use of this soil for timber production. Roads tend to rut, and traction for equipment is poor. Trees can be harvested by conventional methods, but these methods can be restricted during winter and spring.

This soil has good potential for grazing where the canopy has been opened by logging or fire. Seeding disturbed areas of this soil to grass increases forage production. Important forage plants are seeded grasses, Idaho fescue, bluebunch wheatgrass, blue wildrye, bluegrass, hawkweed, and arrowleaf balsamroot. Shrubs, such as snowberry and white spirea, can dominate the vegetation once the canopy is opened. Management of vegetation should be designed to protect timber regeneration and to increase production of Idaho fescue and bluebunch wheatgrass.

This soil produces forage for livestock and big game animals continually under woodland management. If not managed, forage is produced for 25 to 40 years. The total annual production varies from 2,000 pounds of air-dry forage per acre to less than 120 pounds per acre as the canopy closes.

This soil has potential as openland and woodland wildlife habitats. Cultivated areas provide food and cover for upland game species, such as cottontail, ring-necked pheasant, and Hungarian partridge. Woodland areas provide habitat for white-tailed deer, songbirds, and black bear.

The slow permeability and a perched water table restrict the use of this Southwick soil for sanitary facilities and homesite development. The construction of roads is limited because of the potential frost action and the low strength of the soil. Dust during summer limits the use of this soil for recreational facilities. Capability subclass IIIe.

64-Southwick silt loam, 12 to 20 percent slopes. This soil is very deep and moderately well drained. It formed in deep loess at elevations between about 2,300 to 3,200 feet. This soil supports a ponderosa pine-snowberry plant community. The average annual precipitation is about 23 inches. Average annual air temperature is about 46 degrees F.

Included with this soil in mapping are areas of Larkin silt loam and Taney silt loam. These soils have slopes of 12 to 20 percent.

This soil has slow permeability. Effective rooting depth is 60 inches, and available water capacity is 11 to 13 inches. A perched water table is at a depth of 36 to 42 inches from February to April. Surface runoff is rapid, and the hazard of erosion is high.

In a typical profile the surface layer is dark grayish brown, medium acid silt loam about 18 inches thick. The subsoil is pale brown, medium acid silt loam about 6 inches thick. Below this is a buried subsurface layer that is very pale brown, medium acid silt loam about 8 inches thick. The buried subsoil is brown, yellowish brown, and pale brown, slightly acid silty clay loam to a depth of more than 60 inches.

Most areas of this soil are in cultivated crops. Common crops are wheat, barley, peas, grass seed, hay, and pasture. Some timber is produced in these areas.

This Southwick soil is important in farming. Under good management, it produces good yields of all adapted crops. An adequate conservation program can be achieved under a continuous cropping system, such as small grain and peas, used with minimum tillage and crop residue.

Field strips and divided slope farming can be used to reduce runoff and control erosion. Grassed waterways are needed to prevent the formation of gullies in drainageways where the runoff is significant. Other desirable practices for erosion control are contour farming, terraces, and field stripcropping. Legume-grass crop is a good erosion control measure for this soil. Applications of nitrogen, sulfur, and occasional phosphorus fertilizers are needed in all cropping systems. Weed control is beneficial to crop yields.

This soil is suited to the production of ponderosa pine. It is capable of producing about 7,000 cubic feet per acre 0.6 inch and more in diameter or 26,000 board feet (Scribner rule) of merchantable timber 11.6 inches and more in diameter from an unmanaged stand of 80 year old trees.

The slow permeability and a perched water table restrict the use of this soil for timber production. These features also cause the surface soil to rut easily and causes equipment traction loss during the rainy periods of winter and spring. Trees can be harvested by using conventional methods, but these methods can be restricted during the rainy period.

This soil has potential for grazing where the canopy has been opened by logging or fire. Seeding disturbed areas of this soil to adapted grasses increases forage production. Important forage plants are seeded grasses, Idaho fescue, rough fescue, bluebunch wheatgrass, blue wildrye, bluegrass, rose, and hawkweed. Shrubs can dominate the vegetation once the canopy is opened. Management of vegetation should be designed to protect timber regeneration and to increase production of grasses.

This soil produces forage for livestock and big game animals continually under woodland management. If not managed, forage is produced for 25 to 40 years. The total annual production varies from 2,000 pounds of air-dry forage per acre to less than 200 pounds per acre as the canopy closes.

This soil has potential as woodland and openland wildlife habitats. Woodland areas support white-tailed deer, black bear, small rodents, ruffed grouse, and various songbirds. Cultivated areas provide food and cover for ring-necked pheasant, Hungarian partridge, and cottontail.

The slow permeability, a perched water table, and slope restrict this soil for homesites and sanitary facilities.

Roads need to be designed to offset the low strength of the soil, the moderate shrink-swell, frost action potential, and slope. Capability subclass IVe.

65-Southwick silt loam, 3 to 20 percent slopes, eroded This undulating to hilly soil is very deep and moderately well drained. It is on loess hills at elevations of 2,300 to 3,500 feet. This soil formed in loess. It supports a ponderosa pine-snowberry plant community. The average annual precipitation is about 23 inches, including about 4 feet of snow. Average annual air temperature is about 46 degrees F.

Included with this soil in mapping are areas of Larkin silt loam and Taney silt loam. These soils have slopes of 3 to 20 percent.

This soil has slow permeability. Effective rooting depth is 60 inches, and available water capacity is 11 to 15 inches. A perched water table is at a depth of 26 to 42 inches in spring. Surface runoff is very rapid, and the hazard of erosion is very high.

In a typical profile the surface layer is dark grayish brown, medium acid silt loam about 10 inches thick. The subsoil is pale brown, medium acid silt loam about 6 inches thick. Below this is a buried subsurface layer that is very pale brown, medium acid silt loam about 8 inches thick. The buried subsoil is brown, yellowish brown, and pale brown, slightly acid silty clay loam to a depth of 60 inches.

Most areas of this soil are in cultivated crops. Common crops are wheat, barley, peas, hay, and pasture. Some timber is produced in areas of this soil.

The thin surface layer and slow permeability reduce the water infiltration rate, increase runoff, and reduce the amount of water for storage. An adequate conservation program can be achieved under a continuous cropping system, such as small grain and peas, used with minimum tillage and crop residue. An erosion control program, however, requires extra protection from runoff such as the use of field strips, diversion terraces, or long term sod crops. Low residue crops, such as peas or lentils, do not provide enough surface residue to reduce runoff. Minimum tillage and crop residue use are needed to help control erosion. Grassed waterways are needed in drainageways with sufficient water to cause gully erosion. Applications of nitrogen, sulfur, and phosphorus fertilizers are needed in all cropping systems for sustained high yields.

This Southwick soil is suited to the production of ponderosa pine. It is capable of producing about 7,000 cubic feet per acre 0.6 inch and more in diameter or 26,000 board feet (Scribner rule) of merchantable timber 11.6 inches and more in diameter from an unmanaged stand of 80 year old trees.

The slow permeability in the lower part of the subsoil and the perched water table during winter and spring restrict the use of this soil for timber production. Roads tend to rut, and equipment traction is poor. Trees can be harvested by conventional methods, but these methods can be restricted during wet periods.

This soil has potential for grazing where the canopy has been opened by logging or fire. Seeding disturbed areas of this soil to grasses increases forage production. Important forage plants are seeded grasses, Idaho fescue, bluebunch wheatgrass, blue wildrye, hawkweed, and arrowleaf balsamroot. Low shrubs, such as snowberry and white spirea, can dominate the vegetation once the canopy is opened. Management of vegetation should be designed to protect timber regeneration and to increase production of Idaho fescue and bluebunch wheatgrass.

This soil produces forage for livestock and big game animals continually under woodland management. If not managed, forage is produced for 25 to 40 years. The total annual production varies from 1,800 pounds of air-dry forage per acre to less than 120 pounds per acre as the canopy closes.

This soil has potential as openland and woodland wildlife habitats. Cultivated areas provide habitat for upland game species, such as cottontail, ring-necked pheasant, and Hungarian partridge. Providing additional cover on fence lines and roadsides increases populations of these wildlife. Woodland habitat is used by white-tailed deer, songbirds, and black bear.

The slow permeability and a perched water table restrict the use of the Southwick soil for sanitary facilities and homesite development. The low strength of the soil, the slope, and potential frost action are limitations in the construction of roads. Capability subclass IVe.

66-Taney silt loam, 3 to 7 percent slopes. This undulating to rolling soil is very deep and moderately well drained. It is on dissected loess hills at elevations of 2,300 to 3,200 feet. It formed in loess with a minor influence of volcanic ash. This soil supports a Douglas-fir-snowberry plant community. The average annual precipitation is about 25 inches, including 4 to 5 feet of snow. Average annual air temperature is about 43 degrees F.

Included with this soil in mapping are small areas of Larkin silt loam and Southwick silt loam that have slopes of 3 to 7 percent; Worley silt loam, 10 to 15 percent slopes; and Moctileme silt loam, 0 to 2 percent slopes.

This soil has slow permeability. Effective rooting depth is 60 inches, and available water capacity is 11 to 13 inches. A perched water table is at a depth of 18 to 30 inches in spring. Surface runoff is medium, and the hazard of erosion is moderate.

In a typical profile the surface layer is dark grayish brown and brown, medium acid silt loam about 18 inches thick. The subsoil is pale brown, medium acid silt loam about 7 inches thick. Below this is a buried subsurface layer that is light gray, medium acid silt about 3 inches thick. The buried subsoil is light yellowish brown and pale brown, silty clay loam to a depth of more than 60 inches.

Most areas of this soil are in cultivated crops. They produce small grain, peas, lentils, grass for seed, hay, pasture, and some woodland.

This Taney soil produces satisfactory yields of suitable crops if it is managed well. It erodes more readily than other soils of the area and requires more conservation practices for erosion control. Minimum tillage and managing crop residue are especially important in the cropping system. Grassed waterways, contour farming, divided slope farming, diversions, and gradient terraces are needed to help control erosion. Applications of nitrogen, sulfur, and occasional phosphorus fertilizers are needed. Weed control is beneficial to crop production.

This soil is suited to the production of ponderosa pine and Douglas-fir. It is capable of producing about 7,100 cubic feet per acre 0.6 inch and more in diameter or 26,000 board feet (Scribner rule) of merchantable timber 11.6 inches and more in diameter from an unmanaged stand of 80 year old trees. The slow permeability in the subsoil and a perched water table restrict the use of this soil for timber production. During winter and spring roads tend to rut, and equipment traction is poor. Trees can be harvested by conventional methods, but these methods can be restricted when the soil is wet.

This soil has potential for grazing where the canopy has been opened by logging or fire. Seeding disturbed areas of this soil to grass increases forage production. Important forage plants are seeded grasses, Idaho fescue, bluebunch wheatgrass, bluegrass, blue wildrye, and American vetch. Tall shrubs can dominate the vegetation once the canopy is opened. Management of vegetation should be designed to protect timber regeneration and to increase production of grasses.

This soil produces forage for livestock and big game animals continually under woodland management. If not managed, forage is produced for 15 to 20 years. The total annual production varies from 2,000 pounds of air-dry forage per acre to less than 200 pounds per acre as the canopy closes.

The Taney soil has potential as woodland and openland wildlife habitats. Cultivated areas are suited to upland game birds, and populations can be increased by providing food and cover for them. White-tailed deer, black bear, snowshoe rabbits, squirrels, chipmunks, small rodents, ruffed grouse, and songbirds use woodland areas.

The slow permeability and a perched water table are limitations for homesite development and septic tank absorption fields. Potential frost action is a limitation in the construction of roads. Construction of recreational facilities is restricted by dust when the soil is dry. Capability subclass IIIe.

67-Taney silt loam, 7 to 25 percent slopes. This rolling to hilly soil is very deep and moderately well drained. It is on loess hills at elevations of 2,300 to 3,200 feet. It formed in loess with a minor influence of volcanic ash. This soil supports a Douglas-fir-snowberry plant community. The average annual precipitation is about 25 inches, including 4 to 5 feet of snow. Average annual air temperature is about 43 degrees F.

Included with this soil in mapping are small areas of Larkin silt loam, Worley silt loam, and Southwick silt loam that have slopes of 7 to 25 percent. Also included are small areas of Moctileme silt loam, 0 to 2 percent slopes, in drainageways.

This soil has slow permeability. Effective rooting depth is 60 inches, and available water capacity is 11 to 13 inches. A perched water table is at a depth of 18 to 20 inches in spring. Surface runoff is rapid, and the hazard of erosion is high.

In a typical profile the surface layer is dark grayish brown and brown, medium acid silt loam about 18 inches thick. The upper part of the subsoil is pale brown, medium acid silt loam about 7 inches thick. Below this is a buried subsurface layer that is light *gray,* medium acid silt loam about 3 inches thick. The buried subsoil is light yellowish brown and pale brown, strongly acid to medium acid silty clay loam to a depth of more than 60 inches.

Most areas of this soil are in cultivated crops. They produce small grain, peas, lentils, grass for seed, hay, pasture, and some woodland (fig. 7).

This Taney soil produces satisfactory yields of suitable crops if managed well. It erodes more readily than other soils of the area and, consequently, requires more conservation practices for erosion control. Continuous cropping is adequate, if it is used with minimum tillage and crop residue management. Runoff control measures, such as field strips, diversions, or gradient terraces, are also helpful. Grassed waterways are needed in drainageways to help control gully erosion. Other desirable practices are contour farming and divided slope farming. Applications of nitrogen, sulfur, and occasional phosphorus fertilizers are needed. Weed control is beneficial to crop yields.

This soil is suited to the production of ponderosa pine and Douglas-fir. It is capable of producing about 7,100 cubic feet per acre 0.6 inch and more in diameter or 26,00 board feet (Scribner rule) of merchantable timber 11.6 inches and more in diameter from an unmanaged stand of 80 year old trees. The slow permeability in the subsoil and a perched water table restrict the use of this soil for timber production. During winter and spring roads tend to rut, and equipment traction is poor. Trees can be harvested by conventional methods, but these methods can be restricted when the soil is wet.

This soil has potential for grazing where the canopy has been opened by logging or fire. Seeding disturbed areas of this soil to grass increases forage production. Important forage plants are seeded grasses, Idaho fescue, bluebunch wheatgrass, bluegrass, blue wildrye, and American vetch. Tall shrubs can dominate the vegetation once the canopy is opened. Management of vegetation should be designed to protect timber regeneration and to increase production of grasses.

This soil produces forage for livestock and big game animals continually under woodland management. If not managed, forage is produced for 15 to 20 years. The total annual production varies from 2,000 pounds of air-dry forage per acre to less than 200 pounds per acre as the canopy closes.

This soil has potential as woodland and openland wildlife habitats. Cultivated areas are suited to upland game birds, and populations can be increased by providing food and cover for them. White-tailed deer, black bear, snowshoe rabbit, squirrels, chipmunks, small rodent-type animals, ruffed grouse, and songbirds are suited to woodland areas.

-The slow permeability in the subsoil and a perched water table are limitations for homesite development and septic tank absorption fields. Slope is also a consideration in areas where it is more than 15 percent. Septic tank absorption fields do not function properly on this soil. Damage from potential frost action and the slope are limitations in the construction of roads.

Construction of recreational facilities is limited by dust when the soil is dry. Capability subclass IVe.

68-Taney silt loam, 3 to 25 percent slopes, eroded. This undulating to hilly soil is very deep and moderately well drained. It is on dissected loess hills at elevations of 2,300 to 3,200 feet. It formed in loess with a minor influence of volcanic ash. This soil supports a Douglas-fir-snowberry plant community. The average annual precipitation is about 25 inches, including 4 to 5 feet of snow. Average annual air temperature is about 43 degrees F.

Included with this soil in mapping are small areas of Larkin silt loam and Southwick silt loam that have slopes of 3 to 25 percent and Worley silt loam, 10 to 25 percent slopes. Also included are small areas of Moctileme silt loam, 0 to 2 percent slopes, in drainageways.

This soil has slow permeability. Effective rooting depth is 60 inches, and available water capacity is 11 to 13 inches. A perched water table is at a depth of 18 to 30 inches in spring. Surface runoff is rapid, and the hazard of erosion is high.

In a typical profile the surface layer is brown, medium acid silt loam about 10 inches thick. The subsoil is pale brown, medium acid silt loam about 7 inches. Below this is a buried subsurface layer that is light gray, medium acid silt about 3 inches thick. The buried subsoil is light yellowish brown and pale brown, strongly acid to medium acid silty clay loam to a depth of 60 inches.

Most areas of this soil are in cultivated crops. They produce small grain, peas, lentils, grass for seed, hay, and pasture.

This soil is associated and farmed with the uneroded Taney soils. The shallow depth of this soil to the slowly permeable subsoil reduces water infiltration and increases runoff and soil erosion, resulting in a decrease in crop yields. Peas and lentils do not provide enough crop residue for erosion control. A continuous cropping sequence of small grain used with minimum tillage and crop residue needs extra protection, such as field strips, to adequately control soil erosion.

Grassed waterways are needed in drainageways that have sufficient runoff to cause gully erosion. In some places, it is necessary to use sod crops to control soil erosion. Applications of nitrogen, sulfur, and occasional phosphorus fertilizers are needed in all cropping systems.

This Taney soil is suited to the production of ponderosa pine and Douglas-fir. It is capable of producing about 7,100 cubic feet per acre 0.6 inch and more in diameter or 26,000 board feet (Scribner rule) of merchantable timber 11.6 inches and more in diameter from an unmanaged stand of 80 year old trees. The slow permeability and a perched water table restrict the use of this soil for timber production. During winter and spring roads tend to rut, and equipment traction is poor. Trees can be harvested by conventional methods, but these methods can be restricted during wet periods.

This soil has potential for grazing where the canopy has been opened by logging or fire. Seeding disturbed areas of this soil to grass increases forage production. Important forage plants are seeded grasses, Idaho fescue, bluebunch wheatgrass, bluegrass, blue wildrye, and American vetch. Tall shrubs may dominate the vegetation once the canopy has been opened. Management of vegetation should be designed to protect timber regeneration and to increase production of grasses.

This soil produces forage for livestock and big game animals continually under woodland management. If not managed, forage is produced for 15 to 20 years. The total annual production varies from 2,000 pounds of air-dry herbage per acre to less than 150 pounds per acre as the canopy closes.

This soil has potential as woodland and openland wildlife habitats. Cultivated areas support upland game birds, and populations can be increased by providing food and cover for them.

The slow permeability and a perched water table are limitations for homesite development. Septic tank absorption fields do not function properly because of these limitations. The slope and potential frost action are limitations in the construction of roads.

Construction of recreational facilities is limited by dust when the soil is dry. Capability subclass IVe.

69-Tekoa shaly silt loam, 5 to 20 percent slopes. This rolling to hilly soil is moderately deep and well drained. It is on mountains at elevations of 2,500 to 4,000 feet. It formed in residuum derived from shale, siltstone, or sandstone with a mantle of loess and volcanic ash. This soil supports a Douglas-fir-snowberry plant community. The average annual precipitation is about 22 inches. Average annual air temperature is about 47 degrees F.

Included with this soil in mapping are areas of Schumacher silt loam, 3 to 25 percent slopes, and Naff silt loam and Palouse silt loam that have slopes of 7 to 25 percent.

This soil has moderate permeability. Effective rooting depth is 20 to 40 inches, and available water capacity is about 3 inches. Surface runoff is rapid, and the hazard of erosion is high.

In a typical profile the surface layer is Clark grayish brown, neutral shaly silt loam about 11 inches thick. The subsoil is brown and yellowish brown, neutral shaly silt loam and very shale loam about 18 inches thick. Weathered shale is at a depth of about 29 inches.

This Tekoa soil is used for timber production, grazing, and wildlife. A few cleared areas are used for small grain, hay, and pasture.

This soil is suited to the production of ponderosa pine and Douglas-fir. It is capable of producing about 4,900 cubic feet per acre 0.6 inch and more in diameter or 18,500 board feet (Scribner rule) 11.6 inches or more in diameter of merchantable timber per acre on a normal unmanaged stand of 80 year old trees. Low available water capacity restricts the use of this soil for timber production because it influences seedling survival.

This Tekoa soil has potential for grazing where the tree canopy is opened by logging, fire, or some other disturbance. Seeding disturbed areas of this soil to adapted grasses increases forage production and helps protect the soil. Important forage plants are seeded grasses, elk sedge, mountain maple, red-stem ceanothus, pinegrass, and Idaho fescue. Low shrubs tend to dominate the vegetation once the canopy is opened. Management of vegetation should be designed to protect timber regeneration and to insure adequate litter for soil protection.

This soil produces forage for livestock and big game animals for 20 to 30 years following opening of the canopy. During this period, the total production varies from about 1,800 pounds of air-dry forage per acre to less than 200 pounds per acre as the canopy closes.

This soil has potential as woodland wildlife habitat for white-tailed deer, elk, black bear, chipmunks, squirrels, and forest grouse.

Depth to bedrock is a limitation for homesite development and septic tank absorption fields. Road construction is also limited by potential frost action.

Dust, small stones, and the slopes are limitations for recreational facilities. Capability subclass VIe.

70-Tekoa shaly silt loam, 20 to 35 percent slopes. This hilly to steep soil is moderately deep and well drained. It is on mountains at elevations of 2,500 to 4,000 feet. It formed in residuum derived from shale, siltstone, or sandstone with a mantle of loess and volcanic ash. This soil supports a Douglas-fir-snowberry plant community. The average annual precipitation is about 22 inches. Average annual air temperature is about 47 degrees F.

Included with this soil in mapping are areas of Ardenvoir gravelly loam and McCrosket gravelly silt loam. These included soils have slopes of 10 to 35 percent.

This soil has moderate permeability. Effective rooting depth is 20 to 40 inches, and available water capacity is about 3 inches. Surface runoff is very rapid, and the hazard of erosion is very high.

In a typical profile the surface layer is Clark grayish brown, neutral shaly silt loam about 11 inches thick. The subsoil is brown and yellowish brown, neutral shaly silt loam and very shaly loam about 18 inches thick. Weathered shale bedrock is at a depth of about 29 inches.

This Tekoa soil is used for timber production, grazing, and wildlife. It is suited to the production of ponderosa pine and Douglas-fir. It is capable of producing about 4,900 cubic feet per acre 0.6 inch and more in diameter or 12,200 board feet (Scribner rule) 11.6 inches or more in diameter of merchantable timber per acre on a normal unmanaged stand of 80 year old trees. Timber production is restricted on this soil by the low available water capacity, which influences seedling survival, and by the very high hazard of erosion.

This soil has potential for grazing where the tree canopy is opened by logging, fire, or some other disturbance. Seeding disturbed areas of this soil to adapted grasses increases forage production and helps protect the soil. Important forage plants are seeded grasses, elk sedge, mountain maple, red-stem ceanothus, pinegrass, and Idaho fescue. Low shrubs tend to dominate the vegetation once the canopy is opened. Management of vegetation should be designed to protect timber regeneration and to insure adequate litter for soil protection.

This soil produces forage for livestock and big game animals for 20 to 30 years following opening of the canopy. During this period, the total production varies from about 1,800 pounds of air-dry herbage per acre to less than 200 pounds per acre as the canopy closes.

This soil has potential as woodland wildlife habitat for white-tailed deer, elk, black bear, chipmunks, squirrels, and forest grouse.

The slope and depth to bedrock are limitations for homesite development, road construction and septic tank absorption fields. Road construction is also limited by potential frost action.

The slope, dust, and small stones limit the use of this soil for recreational facilities. Capability subclass VIe.

71-Tekoa shaly silt loam, 35 to 60 percent slopes. This steep to very steep soil is moderately deep and well drained. It is on mountains at elevations of 2,500 to 4,000 feet. It formed in residuum derived from shale, siltstone, or sandstone with a mantle of loess and volcanic ash in the upper part. This soil supports a Douglas-fir-snowberry plant community. Average annual air temperature is about 47 degrees F.

Included with this soil in mapping are areas of Ardenvoir gravelly loam and McCrosket gravelly silt loam. These included soils have slopes of 35 to 65 percent.

This soil has moderate permeability. Effective rooting depth is 20 to 40 inches, and available water capacity is about 3 inches. Organic matter content is high in the surface layer. Surface runoff is very rapid, and the hazard of erosion is very high.

In a typical profile the surface layer is dark grayish brown, neutral shaly silt loam about 11 inches thick. The subsoil is brown and yellowish brown, neutral shaly silt loam and very shaly loam about 18 inches thick. Weathered shale is at a depth of about 29 inches.

This Tekoa soil is used for timber production, watershed, and wildlife habitat. It is suited to the production of ponderosa pine and Douglas-fir. It is capable of producing about 4,900 cubic feet per acre 0.6 inch and more in diameter or 12,200 board feet (Scribner rule) 11.6 inches or more in diameter of merchantable timber per acre on a normal unmanaged stand of 80 year old trees. Very steep slopes and the very high hazard of erosion restrict the use of this soil for timber production.

This soil must be managed to keep soil losses to a minimum, thus maintaining the watershed potential. The concern in meeting this goal is the careful management of the timber resource and understory vegetation.

This soil has some potential for grazing where the tree canopy is opened up by logging, fire, or other disturbance. Seeding disturbed areas of this soil to adapted grasses increases vegetation cover and helps protect the soil. Important forage plants are seeded grasses, elk sedge, mountain maple, red-stem ceanothus, pinegrass, and Idaho fescue. Low shrubs tend to dominate the vegetation once the canopy is opened. Management of vegetation should be designed to protect timber regeneration, to provide good vegetation cover, and to insure adequate litter for soil protection.

This soil produces forage for grazing for 20 to 30 years following the opening of the canopy. During this period, the total annual production varies from about 1,800 pounds of air-dry forage per acre to less than 200 pounds per acre as the canopy closes. Livestock movement and accessibility of forage are restricted by the very steep slopes.

This soil has potential as woodland wildlife habitat for white-tailed deer, elk, black bear, chipmunks, squirrels, and forest grouse.

Very steep slopes are limitations for homesite development and road construction. They also limit the use of this soil for recreational facilities. Capability subclass VII e.

72-Tekoa-Rock outcrop complex. This map unit consists of rolling to hilly soils on mountains at elevations of 2,500 to 4,000 feet. It is about 55 percent Tekoa shaly silt loam, 5 to 35 percent slopes, and about 30 percent Rock outcrop. The Rock outcrop consists of many small exposures of shale. It is so interspersed within areas of the Tekoa soil that it is not shown separately on the soil map. The Tekoa soil supports a Douglas-fir-snow berry plant community. The average precipitation is about 22 inches. Average annual air temperature is about 47 degrees F.

The Tekoa soil is moderately deep and well drained. It formed in residuum derived from shale, siltstone, or sandstone with a mantle of loess and volcanic ash. Permeability is moderate. Effective rooting depth is 20 to 40 inches, and available water capacity is about 3 inches. Surface runoff is very rapid, and the hazard of erosion is very high.

In a typical profile of the Tekoa soil the surface layer is dark grayish brown, neutral shaly silt loam about 11 inches thick. The subsoil is brown and yellowish brown, neutral shaly silt loam and very shaly loam about 18 inches thick. Weathered shale is at depth of about 29 inches.

Rock outcrop consists of exposures of shale or sandstone. The rock outcrops are 10 to 30 feet apart and prohibit the use of all, except light, machinery.

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

4,900 cubic feet per acre 0.6 inch and more in diameter or 12,200 board feet (Scribner rule) 11.6 inches or more in diameter of merchantable timber per acre on a normal unmanaged stand of 80 year old trees. The low available water capacity, which influences seedling survival, and the Rock outcrop restrict the use of this soil for timber production. The Rock outcrop severely restricts the use of large machinery. Timber harvest needs careful planning and design for the area involved.

The Tekoa soil has potential for grazing where the tree canopy is opened up by logging, fire, or other disturbances. Seeding disturbed areas of this soil to adapted grasses increases forage production and helps protect the soil. Important forage plants are seeded grasses, elk sedge, mountain maple, red-stem ceanothus, pinegrass, and Idaho fescue. Low shrubs tend to dominate the vegetation once the canopy is opened. Management of vegetation should be designed to protect timber regeneration and to insure adequate plant cover and plant litter for soil protection.

The Tekoa soil produces forage for grazing for 20 to 30 years following opening of the canopy. During this period, the total annual production varies from 1,800 pounds of air-dry herbage per acre to less than 200 pounds per acre as the canopy closes.

This map unit is not used for homesites because of the Rock outcrop. Rock outcrop limits this map unit for camp areas, paths, and trails. Capability subclass VIIs.

73-Tensed-Pedee silt loans, 3 to 25 percent slopes. These undulating to hilly soils are on the dissected terraces at elevations of 2,500 to 3,200 feet. The average annual precipitation is about 24 inches, including 4 to 5 feet of snow. Average annual air temperature is about 47 degrees F. This map unit is about 60 percent Tensed silt loam and about 35 percent Pedee silt loam. The Tensed soil is in depressions of terraces, and the Pedee soil is on the ridges or in higher areas. Both soils support a Douglas-fir-snowberry plant community.

Included with these soils in mapping are Southwick silt loam, Taney silt loam. and Worley silt loam and small areas of severely eroded Tensed and Pedee soils. These included soils make up 5 percent of the map unit_

The Tensed soil is very deep and moderately well drained. It formed in colluvium derived from metasedimentary rock with a mantle of loess. Permeability is slow. Effective rooting depth is 60 inches, and available water capacity is 9 to 10 inches. Surface runoff is very rapid, and the hazard of erosion is very high. A perched water table is at a depth of 24 to 30 inches from February to April.

In a typical profile of the Tensed soil the surface layer is grayish brown, medium acid silt loam about 8 inches thick. The subsoil is brown, slightly acid silt loam about 10 inches thick. Below this is a buried subsurface layer that is light gray, neutral silt loam about 5 inches thick. The buried subsoil is light yellowish brown, neutral silty clay loam and very gravelly clay loam to a depth of 60 inches.

The Pedee soil is very deep and moderately well drained. It formed in colluvium derived from metasedimentary rock with a mantle of loess. Permeability is very slow. Effective rooting depth is 60 inches, and available water capacity is 7 to 8 inches. Surface runoff is very rapid, and the hazard of erosion is very high. A perched water table is at a depth of 18 to 24 inches from February to April.

In a typical profile of the Pedee soil the surface layer is dark grayish brown, medium acid silt loam about 10 inches thick. The subsoil is brown, strongly acid gravelly silt loam about 9 inches thick. Below this is a buried subsurface layer that is very pale brown, strongly acid very gravelly silt loam about 3 inches thick. The buried subsoil is brown, reddish brown, and pink, strongly acid to neutral very gravelly clay and very gravelly clay loam to a depth of 60 inches.

Most areas of these soils are used for timber. Some are used for grazing and for crops.

Continuous cropping of small grain and small grain alternating with peas or lentils are common cropping systems on these soils. Peas and lentils can be used only if the soils are farmed in a divided slope or field strip system because of the very high hazard of erosion. Minimum tillage, contour farming, and crop residue use are also needed. Grassed waterways are needed in the drainageways where runoff is significant and gully erosion is a danger.

The Tensed and Pedee soils are suited to the production of Douglas-fir and ponderosa pine. These soils are capable of producing about 4,900 cubic feet per acre 0.6 inch and more in diameter or 12,200 board feet (Scribner rule) or merchantable timber 11.6 inches and more in diameter from an unmanaged stand of 80 year old trees. The slow permeability of the Tensed soil, the very slow permeability in the subsoil of the Pedee soil, and a perched water table during winter and spring restrict the use of these soils for timber production. Trees can be harvested by conventional methods, but wet periods can restrict these methods.

The soils of this unit have potential for grazing where the tree canopy is opened. Seeding disturbed areas of these soils to adapted grasses increases forage production and helps protect the soil. Important forage plants are seeded grasses, elk sedge, rough fescue, bluebunch wheatgrass, red maple, and red-stem ceanothus. Shrubs tend to dominate the vegetation where the canopy is opened. Management of vegetation should be designed to protect timber regeneration and to provide good plant cover and plant litter for soil protection.

The soils of this unit produce forage for grazing for 20 to 30 years following opening of the canopy. The total annual production varies with the tree canopy density from 2,000 pounds of air-dry forage per acre to 200 pounds per acre as the canopy closes.

These soils are suited to openland and woodland wildlife habitats. Cultivated areas are suited to upland game birds. Populations of these birds can be increased by planting hedgerows along fences and roadsides to provide cover and protection. Grain strips also provide food and some cover. Woodland areas are suited to white-tailed deer, elk, black bear, small rodents, rabbits, forest grouse, and songbirds.

The restricted permeability in the subsoil and a perched water table during wet periods are limitations for homesite development and septic tank absorption fields. Road construction is limited by potential frost action.

Restricted permeability and dust limit recreational facilities. Capability subclass IVe.

74-Tensed-Pedee silt loams, 25 to 35 percent slopes. These hilly to steep soils are on dissected terraces at elevations of 2,500 to 3,200 feet. The average annual precipitation is about 24 inches, including 4 to 5 feet of snow. Average annual air temperature is about 47 degrees F. This map unit is about 60 percent Tensed silt loam and about 35 percent Pedee silt loam. The Tensed soil is in depressions on terraces, and the Pedee soil is on the ridgetops or in higher areas. Both soils support a Douglas-fir-snowberry plant community.

Included with these soils in mapping are Southwick silt loam, Taney silt loam and Worley silt loam that have slopes of 10 to 25 percent. These included soils make up 5 percent of the map unit.

The Tensed soil is very deep and moderately well drained. It formed in colluvium derived from metasedimentary rock with a mantle of loess. Permeability is slow. Effective rooting depth is 60 inches, and available water capacity is 9 to 10 inches. Surface runoff is very rapid, and the hazard of erosion is very high. A perched water table is at a depth of 24 to 30 inches from February to April.

In a typical profile of the Tensed soil the surface layer is grayish brown, medium acid silt loam about 8 inches thick. The subsoil is brown, slightly acid silt loam about 10 inches thick. Below this is a buried subsurface layer that is light gray, neutral silt loam about 5 inches thick. The buried subsoil is light yellowish brown, neutral silty clay loam and very gravelly clay loam to a depth of 60 inches.

The Pedee soil is very deep and moderately well drained. It formed in colluvium derived from metasedimentary rock with a mantle of loess. Permeability is very slow. Effective rooting depth is 60 inches, and available water capacity is 7 to 8 inches. Surface runoff is very rapid, and the hazard of erosion is very high. A perched water table is at a depth of 18 to 24 inches from February to April.

In a typical profile of the Pedee soil the surface layer is dark grayish brown, medium acid silt loam about 10 inches thick. The subsoil is brown, medium acid silt loam about 9 inches thick. Below this is a buried subsurface layer that is very pale brown, strongly acid very gravelly silt loam about 3 inches thick. The buried subsoil is brown, reddish brown, and pink, strongly acid to neutral very gravelly clay and very gravelly clay loam to a depth of 60 inches.

The soils in this unit are used mainly for timber production and some grazing.

Both soils are suited to the production of Douglas-fir and ponderosa pine. They are capable of producing about 4,900 cubic feet per acre 0.6 inch and more in diameter or 12,200 board feet (Scribner rule) of merchantable timber 11.6 inches and more in diameter from an unmanaged stand of 80 year old trees. The slow permeability of the Tensed soil, the very slow permeability of the Pedee soil, and a perched water table during winter and spring restrict the use of these soils for timber production. Trees can be harvested by conventional methods, but wet periods can restrict these methods. Care must be exercised in the selection of landings and skid trails to minimize soil losses.

These soils have potential for grazing where the tree canopy is opened. Seeding disturbed areas of these soils to adapted grasses increases forage production and helps protect the soil. Important forage plants include seeded grasses, elk sedge, rough fescue, bluebunch wheatgrass, red maple, and red-stem ceanothus. Shrubs tend to dominate the vegetation where the canopy is opened. Management of vegetation should be designed to protect timber regeneration and to provide good plant cover and plant litter for soil protection. These soils have potential for grazing for 20 to 30 years following the opening of the canopy. The total annual production varies with the tree canopy density from 2,000 pounds of air-dry forage per acre to 200 pounds per acre as the canopy closes.

These soils have potential as woodland wildlife habitat for white-tailed deer, elk, black bear, squirrels, chipmunks, small rodents, rabbits, forest grouse, and songbirds.

A perched water table and the slope are limitations for homesite development on both of these soils. Main concerns to absorption fields are the slow permeability of the Tensed soil, the very slow permeability of the Pedee soil, and slope. Septic tank absorption fields could contaminate nearby streams because of the perched water table. Limitations in the construction of roads are the perched water table, potential frost action and slope. Slope is the main limitation in the development of recreational uses of these soils. Capability subclass VIe.

75-Thatuna-Naff silt loams, 7 to 25 percent slopes. These rolling to hilly soils are on dissected, loess hills at elevations of about 2,400 to 3,200 feet. This map unit is about 40 percent Thatuna silt loam and about 35 percent Naff silt loam. The average annual precipitation is about 20 inches. Average annual air temperature is about 47 degrees F. The Naff soil is in convex positions on the landscape, and the Thatuna soil is in concave positions.

Included with these soils in mapping are Palouse silt loam and Tilma silt loam. These soils make up 25 percent of the map unit.

The Thatuna soil is very deep and moderately well drained. It formed in deep loess. Permeability is slow. Effective rooting depth is 60 inches, and available water capacity is 10 to 13 inches. Surface runoff is rapid, and the hazard of erosion is high. A perched water table is at a depth of 36 to 48 inches from February to April.

In a typical profile of the Thatuna soil the surface layer is dark grayish brown, neutral silt loam about 19 inches thick. The subsoil is brown, slightly acid silt loam about 8 inches thick. Below this is a buried subsurface layer that is pale brown and very pale brown, slightly acid silt loam about 10 inches thick. The buried subsoil is light yellowish brown and yellowish brown, slightly acid and neutral silt loam and silty clay loam to a depth of about 60 inches.

The Naff soil is very deep and well drained. It formed in loess. Permeability is moderately slow. Effective rooting depth is 60 inches, and available water capacity is 11 to 12 inches. Surface runoff is rapid, and the hazard of erosion is high.

In a typical profile of the Naff soil the surface layer is dark grayish brown and brown, slightly acid and medium acid silt loam about 18 inches thick. The subsoil is pale brown and light yellowish brown, slightly acid and neutral silt loam and silty clay loam to a depth of 60 inches.

The soils of this unit are in cultivated crops, mainly small grain, peas, lentils, and grass seed. Legume-grass hay is also suited and can be grown on moderately steep soils in this unit to help control erosion.

Continuous cropping of grain in various combinations with peas or lentils is a common crop rotation. Minimum tillage and returning crop residue are essential on these soils. Grassed waterways are needed in drainageways where gullying is a danger. Divided slope farming, field strips,- terraces, and contour farming are desirable for erosion control. Applications of nitrogen, phosphorus, and sulfur fertilizers are needed in all cropping systems to sustain high yields.

These Thatuna and Naff soils are suited to openland and rangeland wildlife habitats. Upland game birds are suitable on the cultivated soils. To encourage increased populations of these birds and to provide needed cover and nesting areas, shrub hedgerows can be established along fence lines and roadsides. Protected strip plantings of grain provide food and some cover. Rangeland areas are suited to mule deer, rodents, and songbirds.

The slow permeability and a perched water table of the Thatuna soil and the moderately slow permeability of the Naff soil are limitations for development of homesites and installation of sanitary facilities. The perched water table of the Thatuna soil can cause lateral movement of water, and seepage from septic tank absorption fields could contaminate nearby streams. Community sewage systems are needed in areas of moderate to high density populations. Potential frost action is a limitation in the construction of roads.

Dust and slope are limitations when planning recreational facilities. Capability subclass IIIe.

76-Thatuna-Naff silt loams, 25 to 10 percent slopes. These hilly to steep soils are on loess hills at elevations of about 2,400 to 3,200 feet. This map unit is about 50 percent Thatuna silt loam and about 40 percent Naff silt loam. The average annual air temperature is about 47 degrees F., and the frost-free season is 110 to 160 days. The Thatuna soil is in the concave positions on the landscape and the Naff soil is in the convex positions.

Included with these soils in mapping are Garfield silty clay loam, Tilma silt loam, and eroded areas of Thatuna and Naff soils. These soils make up 10 percent of the map unit.

The Thatuna soil is very deep and moderately well drained. It formed in deep loess. Permeability is slow. Effective rooting depth is 60 inches, and available water capacity is 10 to 13 inches. Surface runoff is very rapid, and the hazard of erosion is very high. A perched water table is at a depth of 36 to 48 inches from February to April.

In a typical profile of the Thatuna soil the surface layer is dark grayish brown, neutral silt loam about 16 inches thick. The subsoil is brown, slightly acid silt loam about 8 inches thick. Below this is a buried subsurface layer that is pale brown and very pale brown, slightly acid silt loam about 10 inches thick. The buried subsoil is light yellowish brown and yellowish brown, slightly acid and neutral silt loam and silty clay loam to a depth of about 60 inches.

The Naff soil is very deep and well drained. It formed in loess. Permeability is moderately slow. Effective rooting depth is 60 inches, and available water capacity is 10 to 12 inches. Surface runoff is very rapid, and the hazard of erosion is very high.

In a typical profile of the Naff soil the surface layer is dark grayish brown and brown, slightly acid and medium acid silt loam about 15 inches thick. The subsoil is pale brown and light yellowish brown, slightly acid and neutral silt loam and silty clay loam to a depth of about 60 inches.

Even though the soils in this map unit have steep slopes, they are in cultivated crops, mainly small grain, peas, lentils, and grass seed. Legume-grass hay is also suitable and is used as an alternate crop on the steep areas to help control erosion. Continuous cropping of grain in various combinations with peas or lentils is a common crop rotation. Minimum tillage and use of crop residue are essential on these soils. An additional practice, such as divided slope farming, is also needed to keep soil erosion to a minimum. Other erosion control practices are contour farming and field stripcropping. Applications of nitrogen, sulfur, and occasional phosphorus fertilizers are needed in all cropping systems.

These soils have potential as openland and rangeland wildlife habitats. Upland game birds are suitable on the cultivated soils. To encourage increased populations of these birds and provide needed cover and nesting areas, shrub hedgerows can be established along fence lines and roadsides. Protected strip plantings of grain also provide food and some cover. Rangeland areas are suited to mule deer, rodents, and songbirds.

The slow permeability and a perched water table of the Thatuna soil, the moderately slow permeability of Naff soils, and the slope are limitations in the development of homesites and installation of necessary sanitary facilities. The perched water table in the Thatuna soil can cause lateral movement of water, and seepage from septic tank absorption fields can cause contamination of nearby streams. Road construction is limited by the slope and the potential frost action.

Slope and dust are the main limitations when planning the installation of recreational facilities. Capability subclass IVe.

77-Water. This map unit consists of perennial streams, lakes, ponds, and marshes. In most years, these areas are covered with water at least during the period that the temperature is high enough for plants to grow, but many are covered throughout the year.

78-Worley silt loam, 10 to 25 percent slopes. This soil is very deep and moderately well drained. It is on narrow ridgetops of loess hills at elevations of 2,300 to 2,800 feet. It formed in deep loess. This soil originally supported a ponderosa pine-snowberry plant community. The average annual precipitation is about 23 inches, including about 4 feet of snow. Average annual air temperature is about 48 degrees F.

Included with this soil in mapping are small areas of Southwick silt loam and Taney silt loam that have slopes of 10 to 25 percent, and Worley silt loam, 3 to 10 percent slopes.

This soil has very slow permeability. Effective rooting depth is 60 inches, and available water capacity is 11 to 13 inches. Surface runoff is very rapid, and the hazard of erosion is very high. A perched water table is at a depth of 18 to 24 inches from February to April.

In a typical profile the surface layer is dark grayish brown, medium acid silt loam about 14 inches thick. The subsoil is brown, medium acid silt loam about 5 inches thick. Below this is a buried subsurface layer that is very pale brown, medium acid silt loam about 1 inch thick. The buried subsoil is brown and light yellowish brown, medium acid to neutral silty clay and silty clay loam to a depth of 60 inches.

Most areas of this soil are in cultivated crops. The main crops are wheat, peas, hay, and pasture. Some barley, lentils, and grass seed are also grown.

This Worley soil is commonly intermingled with the Southwick and Larkin soils. It is productive in farming but has a dense subsoil, which increases runoff under intensive cultivation. Continuous cropping of grain in rotation with peas or lentils is a common rotation. Managing crop residue and minimum tillage are essential in providing protection from runoff. Field strips or sod crops are needed. Diversions and gradient terraces also help to control runoff and erosion. Applications of nitrogen, sulfur, and occasional phosphorus fertilizers are needed in all cropping systems. Weed control is beneficial to crop yields.

This Worley soil is suited to the production of ponderosa pine. It is capable of producing about 4,900 cubic feet per acre 0.6 inch and more in diameter or 12,200 board feet (Scribner rule) of merchantable timber 11.6 inches and more in diameter from an unmanaged stand of 80 year old trees. The very slow permeability in the subsoil and a perched water table restrict the use of this soil for timber production. During winter and spring roads tend to rut, and traction is poor for equipment. Trees can be harvested by conventional methods, but wet periods can restrict these methods.

This soil has potential as woodland and openland wildlife habitats. Increased populations of upland game birds can be encouraged and cover and nesting areas provided in cultivated areas by establishing hedgerows along fences and roads. Protected strips of grain are good food sources. White-tailed deer, black bear, snowshoe rabbits, squirrels, chipmunks, and various songbirds are suited to wooded areas.

The very slow permeability in the subsoil and a perched water table during wet periods are limitations in homesite development. Septic tank absorption fields do not function properly. Other limitations are slope, shrink-swell potential, and low strength of the soil. Dwelling and road designs can be modified to offset these limitations. The very slow permeability, dust, and slope limit installation of recreational facilities. Capability subclass IVe.

79-Worley silt loam, 10 to 25 percent slopes, eroded. This soil is very deep and moderately well drained. It is on narrow ridgetops of loess hills at elevations of 2,300 to 2,800 feet. It formed in deep loess. The average annual precipitation is about 23 inches, including about 4 feet of snow. Average annual air temperature is about 48 degrees F.

Included with this soil in mapping are small areas of Southwick silt loam and Taney silt loam. These soils have slopes of 10 to 25 percent.

This soil has very slow permeability. The surface layer ranges from a few inches to about 10 inches in thickness. Effective rooting depth is 60 inches, and available water capacity is 11 to 13 inches. Surface runoff is very rapid, and the hazard of erosion is very high. A perched water table is at a depth of 18 to 24 inches from February to April.

In a typical profile the surface layer is dark grayish brown, medium acid silt loam about 7 inches thick. The subsoil is brown, medium acid silt loam about 5 inches thick. Below this is a buried subsurface layer that is very pale brown, medium acid silt loam about 1 inch thick. The buried subsoil is brown and light yellowish brown, medium acid to neutral silty clay and silty clay loam to a depth of 60 inches.

Most areas of this soil are in cultivated crops, mainly wheat, peas, hay, and pasture. Some barley, lentils, and grass seed are also grown.

This Worley soil is shallow in depth to the very slowly permeable, silty clay subsoil. When the subsoil is within the tillage zone it is difficult to till and crop production is reduced because of the poor physical condition of the soil. Runoff is a hazard. Continuous small grain, excluding lentils and peas, and sod crops are an adequate cropping system. Minimum tillage and using crop residue are essential in the cropping system. Stripcropping, diversions, contour farming, and divided slope farming help to control runoff. Applications of nitrogen, sulfur, and phosphorus fertilizers are needed in all cropping systems.

This soil is suited to the production of ponderosa pine. It is capable of producing about 4,900 cubic feet per acre 0.6 inch and more in diameter or 12,200 board feet (Scribner rule) of merchantable timber 11.6 inches and more in diameter from an unmanaged stand of 80 year old trees. The *very* slow permeability in the subsoil and a perched water table restrict the use of this soil for timber production. During the rainy periods in winter and spring, roads tend to rut and traction is poor for equipment. Trees can be harvested by using conventional methods, but rainy periods can restrict these methods.

This soil has potential as openland and woodland wildlife habitats. White-tailed deer, black bear, snowshoe rabbits, squirrels, chipmunks, and various songbirds are suited to wooded areas. Cultivated areas are suited to upland game birds. Populations of these birds can be increased by planting hedgerows along fences and roadsides for cover and nesting. Protected strips of grain provide food and some cover.

The very slow permeability and a perched water table during the wet season are limitations for homesite development. Septic tank absorption fields do not function properly because of these limitations. Other limitations are the slope, shrink-swell potential, and low strength of the soil. Dwelling and road designs can be modified to offset these limitations. The very slow permeability, dust, and the slope must be considered when planning recreational facilities. Capability subclass IVe.

Use and management of the soils

The soil survey is a detailed inventory and evaluation of the most basic resource of the survey area-the soil. It is useful in adjusting land use, including urbanization, to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in uses of the land.

While a soil survey is in progress, soil scientists, conservationists, engineers, and others keep extensive notes about the nature of the soils and about unique aspects of behavior of the soils. These notes include data on erosion, drought damage to specific crops, yield estimates, flooding, the functioning of septic tank disposal systems, and other factors affecting the productivity, potential, and limitations of the soils under various uses and management. In this way, field experience and measured data on soil properties and performance are used as a basis for predicting soil behavior.

Information in this section is useful in planning use and management of soils for crops and pasture, rangeland, and woodland, as sites for buildings, highways and other transportation systems, sanitary facilities, and parks and other recreation facilities, and for wildlife habitat. From the data presented, the potential of each soil for specified land uses can be determined, soil limitations to these land uses can be identified, and costly failures in houses and other structures, caused by unfavorable soil properties, can be avoided. A site where soil properties are favorable can be selected, or practices that will overcome the soil limitations can be planned.

Planners and others using the soil survey can evaluate the impact of specific land uses on the overall productivity of the survey area or other broad planning area and on the environment. Productivity and the environment are closely related to the nature of the soil. Plans should maintain or create a land-use pattern in harmony with the natural soil.

Contractors can find information that is useful in locating sources of sand and gravel, roadfill, and topsoil. Other information indicates the presence of bedrock, wetness, or very firm soil horizons that cause difficulty in excavation.

Health officials, highway officials, engineers, and many other specialists also can find useful information in this soil survey. The safe disposal of wastes, for example, is closely related to properties of the soil. Pavements, sidewalks, campsites, playgrounds, lawns, and trees and shrubs are influenced by the nature of the soil.

Crops and pasture

KENNETH E. RIERSGARO, agronomist, and DENNIS K. FROEMING, range conservationist, Soil Conservation Service, helped to prepare this section

More than 81,330 acres in the survey areas were used for crops and pasture in 1967 (9). Of this total 61,330 acres were used for field crops; 16,000 acres were used for hay and pasture; and the rest was idle cropland.

The major management concerns in the use of the soils for crops and pasture are described in this section. In addition, the crops or pasture plants best suited to the soil, including some not commonly grown in the survey area, are discussed; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are presented for each soil.

This section provides information about the overall agricultural potential of the survey area and about the management practices that are needed. The information is useful to equipment dealers, land improvement contractors, fertilizer companies, processing companies, planners, conservationists, and others. For each kind of soil, information about management is presented in the section "Soil maps for detailed planning." Planners of management systems for individual fields or farms should also consider the detailed information given in the description of each soil.

Most of the cropland in the survey area is in the western half of Benewah County along the Washington state line. Cropland makes up most of the landscape anti consists of productive grassland such as that on the Palouse, Naff, and Thatuna soils. To the east of this, the cropland is broken by steep, wooded ridges and finally gives way to woodland.

Winter wheat has been the most economic crop (fig. 8). Bluegrass seed has been an important cash crop since the mid 1960's. Lentils, dry peas, and barley are also important. The seeded acreage of these crops varies annually, but these crops are significant components of the continuous cropping system, along with wheat and grass seed. In the eastern part of the cropland on forest soils, such as Larkin, Southwick, and Taney, peas and lentils are less prevalent because these soils are less productive. Barley is common, but wheat is the main cash crop. Legume-grass hay also is significant in this part of the survey area.

The main concern in conservation on all of the cropland is erosion caused by runoff. The bottom lands are less affected, but they sometimes are scoured by runoff from adjacent hills. Soil losses from erosion in the past years can be largely attributed to summer fallow. Almost since the land was first cultivated, summer fallow was commonly used for weed control in the wheat, pea, barley rotation system. This practice resulted in severe soil losses on some of the sloping lands. Annual soil losses of 50 to 100 tons per acre were not uncommon. This practice has been largely abandoned; and continuous cropping with chemical weed control, is commonly used. Annual soil losses have been reduced appreciably because of annual cropping.

Management practices that are needed on cropland soils to help control erosion are continuous cropping and minimum tillage. Past experience shows that excessive tillage is damaging and promotes erosion. Contour cropping, stubble utilization, divided slope farming, or gradient terraces are needed on the more steeply sloping soils to help keep soil losses to a minimum. Use of sod crops on eroded soils and steep slopes is an alternative in management. Important to any cropping system is controlling the large amount of runoff in the natural drainageways during spring. Unless it is controlled, this water causes gullies to form and yields large amounts of sediment. Grassed waterways in these drainageways prevent gullies from forming and are an important function in supporting a good cropping system.

Drainage from local seepage is a minor concern in cropland in the western part of the survey area. Collectively the loss in production from many small seep areas could be fairly significant because these areas do not produce crops to their fullest potential. These seepage areas need effective tile drains that have outlets into existing drainageways.

Wetness and flooding are the main concerns on soils, such as the Miesen, DeVoignes, and Pywell soils, on the St. Joe River flood plain. These soils have a seasonal high water table and are subject to flooding unless they are protected by levees. They must be drained to obtain optimum crop yields.

A fertilizer program is also essential to high production in a continuous cropping system.

A long-term soil maintenance program under a small grain system is possible by using a combination of management practices.

Pasture management

Approximately 13,600 acres (.9) in the survey area are used for improved pasture (fig. 9). Pastureland is mainly those areas that are too steep or too wet for production of annual crops **or** hay production.

Poor management of pasture is common. It includes turning out animals too early in spring before the plants have reached adequate growth; continuous grazing throughout the season; little or no fertilization; overgrazing; and the use of unadapted grass and legume species. As a result, the production of both forage and red meat is reduced; the stand of desirable plants is quickly invaded by weeds; and gullies form in drainageways, especially in the more erodible soils such as the Santa, Helmer, Setters, Tensed, and Taney soils.

Management practices that are needed include cross fencing; water development; proper regrowth periods; a fertilizer program that includes applications of nitrogen, phosphorus, and sulfur; and the use of adapted plants that respond to good management.

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. Absence of an estimated yield indicates that the crop is not suited to or not commonly grown on the soil.

The estimated yields were based mainly on the experience and records of farmers, conservationists, and extension agents. Results of field trials and demonstrations and available yield data from nearby counties were also considered.

The yields were estimated assuming that the latest soil and crop management practices were used. Hay and pasture yields were estimated for the most productive varieties of **grasses** and legumes suited to the climate and the soil. A few farmers may be obtaining average yields higher than those shown in table 5.

The management needed to achieve the indicated yields of the various crops depends on the kind of soil and the crop. Such management provides drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate tillage practices, including time of tillage and seedbed preparation and tilling when soil moisture is favorable; 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 residues, barnyard manure, and green-manure crops; harvesting crops with the smallest possible loss; and timeliness of all fieldwork.

The estimated yields reflect the productive capacity of the soils 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 included because the acreage of these crops is small. The local offices of the Soil Conservation Service and the Cooperative Extension Service can provide information about the management concerns and productivity of the soils for these crops. Also not estimated in table 5 is the productivity of the soils that are not suited to farming.

Capability classes and subclasses

Capability classes and subclasses show, in a general way, the suitability of soils for most kinds of field crops. The soils are classed according to their limitations when they are used for field crops, the risk of damage when they are used, and the way they respond to treatment (8). The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to horticultural crops or other crops that require special management. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for forest trees, or for engineering purposes.

In the capability system, all kinds of soil are grouped at three levels: capability class, subclass, and unit. These levels are defined in the following paragraphs. A survey area may not have soils of all classes.

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 landforms 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 too cold or too 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 a', s, or c because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation.

The capability subclass is identified in the description of each soil mapping unit in the section "Soil maps for detailed planning."

Woodland management and productivity

DAVID .J. POE, woodland conservationist, Soil Conservation Service, helped to prepare this section.

Lumbering has been important in the growth of Benewah County. The first lumber mill was established about 1885. In the early days of lumbering, rivers and streams provided the major means for transporting logs to the mill and the finished product to market.

The St. Joe and St. Maries Rivers, which join at St. Maries before entering the southern end of Coeur d'Alene Lake, have been instrumental in the development of the county. Millions of board feet of lumber were cut from the drainages of these rivers. The development of the area began about 1880; most settlers arrived after the completion of the Mullen Road. When Benewah County was created in 1915, lumbering was well advanced.

Approximately 70 percent of the Benewah County Area is wooded. The average size woodlot is approximately 200 acres. Almost all of the farms in the survey area have some woodland. A large acreage of the woodland is being subdivided annually into 5 to 20 acre lots for homesites.

In 1910 a fire swept through most of the area and left an even-aged stand of trees that did not burn. Harvest cuts have been made in most of the woodlands. Dominant tree species are grand fir, white pine, Douglas-fir, western redcedar, western larch, ponderosa pine, and lodgepole pine. Grand fir has been the main tree species harvested. White pine, Douglas-fir, and western larch have been next.

A large acreage of the woodland is on steep, erodible soils. Management that includes construction of logging roads on gentle grades, proper drainage, and stabilization of disturbed areas is necessary to prevent excessive soil losses. Seeding of disturbed areas to selected grasses and legumes and proper tree harvest methods are also important in helping to control soil erosion.

Table 6 contains information useful to woodland owners or forest managers planning use of soils for wood crops. Map unit symbols for soils suitable for wood crops are listed, and the ordination (woodland suitability) symbol for each soil is given. All soils bearing the same ordination symbol require the same general kinds of woodland management and have about the same potential productivity.

The first part of the *ordination symbol,* a number, indicates the potential productivity of the soils for important trees. The number 1 indicates very high productivity; 2, high; 3, moderately high; 4, moderate; and 5, low. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *x* indicates stoniness or rockiness; *w*, excessive water in or on the soil; *t*, toxic substances in the soil; *d*, restricted root depth; *c*, clay in the upper part of the soil; *s*, sandy texture; *f*, high content of coarse fragments in the soil profile; and *r,* steep slopes. The letter o indicates insignificant limitations or restrictions. If a soil has more than one limitation, priority in placing the soil into a limitation class is in the following order: x, w, t, d, c, s, f, and r.

In table 6 the soils are also rated for a number of factors to be considered in management. *Slight, moderate,* and *severe* are used to indicate the degree of major soil limitations.

Ratings of *equipment limitation* reflect the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. A rating of *slight* indicates that use of equipment is not limited to a particular kind of equipment or time of year; *moderate* indicates a short seasonal limitation or a need for some modification in management or equipment; *severe* indicates a seasonal limitation, a need for special equipment or management, or a hazard in the use of equipment.

Seedling mortality ratings indicate the degree that the soil affects expected mortality of planted tree seedlings. Plant competition is not considered in the ratings. Seedlings from good planting stock that are properly planted during a period of sufficient rainfall are rated. A rating of *slight* indicates that the expected mortality of the planted seedlings is less than 25 percent; *moderate*, 25 to 50 percent; and *severe*, more than 50 percent.

Considered in the ratings of *windthrow* hazard are characteristics of the soil that affect the development of tree roots and the ability of the soil to hold trees firmly. A rating of *slight* indicates that trees in wooded areas are not expected to be blown down by commonly occurring winds; *moderate*, that some trees are blown down during periods of excessive soil wetness and strong winds; and *severe*, that many trees are blown down during periods of excessive soil wetness and moderate or strong winds.

Ratings of *plant competition* indicate the degree to which undesirable plants are expected to invade or grow if openings are made in the tree canopy. The invading plants compete with native plants or planted seedlings by impeding or preventing their growth. A rating of *slight* indicates little or no competition from other plants; *moderate* indicates that plant competition is expected to hinder the development of a fully stocked stand of desirable trees; *severe* means that plant competition is expected to prevent the establishment of a desirable stand unless the site is intensively prepared, weeded, or otherwise managed for the control of undesirable plants.

The potential productivity of merchantable or important trees on a soil is expressed as a site index. This index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, evenaged, unmanaged stands. Important trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

Trees to plant are those that are suitable for commercial wood production and that are suited to the soils.

For use and management of woodland, foresters can use the information given in table 6 along with suitability of the soil for major species that is described in the detailed map unit and volume yields per acre of fully stocked, even aged, unmanaged stands that is given in the literature (4, 5).

Woodland understory vegetation

Understory vegetation consists of grasses, forks, shrubs, and other plants. Some types of forest, under proper management, can produce enough understory vegetation to support grazing of livestock or wildlife, or both.

The quantity anti quality of understory vegetation vary with the kind of soil, the age and kind of trees, the density of the canopy, and the depth and condition of the forest litter. The density of the forest canopy affects the amount of light that understory plants receive during the growing season.

The descriptions of each map unit, in the section "Soil maps for detailed planning," show the potential for producing understory vegetation. The description also lists the common names of the characteristic vegetation for soils that have grazing potential and the total forage production by air-dry weight.

Grazed woodlands

This section was prepared by DENNIS K. FR0EMING, range conservationist, Soil Conservation Service.

The native grazing resources are on the forest lands and are produced in association with timber. In 1967 about 192,600 acres of forest land were grazed in the survey area (9). A small, but important part of the grazing land is made up of small, narrow, stringer-type meadows adjacent to drainageways. Where they exist, these meadows have potential as high forage-producing areas. They are also natural concentration areas for livestock and are commonly in a depleted condition because of continual overuse. A grazing program in an area must be designed so the meadows periodically will be rested to seed maturity.

In the forested areas, the understory vegetation that is produced and used depends upon the amount of sunlight that reaches the forest floor. Generally, when there is about 60 percent or more overstory canopy cover there is no usable forage resource, and the areas are used by livestock for shade and protection only. When a timber stand is opened by logging, fire, insects, or some other disturbance, usable forage is produced until the canopy closes again (fig.10).

Any grazing management system on forest lands must be designed to protect timber regeneration and the standing timber crop. It is also important to provide site protection for the meadows and watercourses if they exist. The most important management practices are planned grazing systems and proper grazing based on selected key plant species in specific areas, such as roads, meadows, or openings. Planned grazing systems provide grazing that allows the key forage plants to rest periodically until seed maturity. Other essential management practices include fencing, having an adequate supply of water, salting away from natural concentration areas, and riding to keep the animals distributed throughout the grazing area.

Windbreaks and environmental plantings

Windbreaks are established to protect livestock, buildings, and yards from wind and snow. Windbreaks also help protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broad-leaved and coniferous species 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 depending on erodibility of the soil. They 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. A healthy planting stock of suitable species planted properly on a well prepared site and maintained in good condition can insure a high degree of plant survival.

Table 7 shows the height that locally grown trees and shrubs are expected to' reach on various kinds of soil in 20 years. The estimates in table 7, based on measurements and observation of established plantings that have been given adequate care, can be used as a guide in planning windbreaks and screens. Additional information about planning windbreaks and screens and the planting and care of trees can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service or from nurserymen.

Engineering

NEIL P. FITZSIMMONS, agricultural engineer, and G. ARTHUR SHOEMAKER, civil engineer, Soil Conservation Service, helped to prepare this section

This section provides information about the use of soils for building sites, sanitary facilities, construction material, and water management. Among those who can benefit from this information are engineers, landowners, community planners, town and city managers, land developers, builders, contractors, and farmers and ranchers.

The ratings in the engineering tables are based on test data and estimated data in the "Soil properties" section. The ratings were determined jointly by soil scientists and engineers of the Soil Conservation Service using known relationships between the soil properties and the behavior of soils in various engineering uses.

Among the soil properties and site conditions identified by a soil survey and used in determining the ratings in this section were grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock that is within 5 or 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure or aggregation, in-place soil density, and geologic origin of the soil material. Where pertinent, data about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of absorbed cations were also considered.

On the basis of information assembled about soil properties, ranges of values can be estimated for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, shear strength, compressibility, slope stability, and other factors of expected soil behavior in engineering uses. As appropriate, these values can be applied to each major horizon of each soil or to the entire profile..

These factors of soil behavior affect construction and maintenance of roads, airport runways, pipelines, foundations for small buildings, ponds and small dams, irrigation projects, drainage systems, sewage and refuse disposal systems, and other engineering works. The ranges of values can be used to (1) select potential residential, commercial, industrial, and recreational uses; (2) make preliminary estimates pertinent to construction in a particular area; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for location of sanitary landfills, onsite sewage disposal systems, and other waste disposal facilities; (5) plan detailed onsite investigations of soils and geology; (6) find sources of gravel, sand, clay, and topsoil; (7) plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; (8) relate performance of structures already built to the properties of the kinds of soil on which they are built so that performance of similar structures on the same or a similar soil in other locations can be predicted; and (9) predict the trafficability of soils for cross-country movement of vehicles and construction equipment.

Data presented in this section are useful for land-use planning and for choosing alternative practices or general designs that will overcome unfavorable soil properties and minimize soil-related failures. Limitations to the use of these data, however, should be well understood. First, the data are generally not presented for soil material below a depth of 5 or 6 feet. Also, because of the scale of the detailed snap in this soil survey, small areas of soils that differ from the dominant soil may be included in mapping. Thus, these data do not eliminate the need for onsite investigations, testing, and analysis by personnel having expertise in the specific use contemplated.

The information is presented mainly in tables. Table 8 shows, for each kind of soil, the degree and kind of limitations for building site development; table 9, for sanitary facilities; and table 11, for water management. Table 10 shows the suitability of each kind of soil as a source of construction materials.

The information in the tables, along with the soil map, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations and to construct interpretive maps for specific uses of land.

Some of the terms used in this soil survey have a special meaning in soil science. Many of these terms are defined in the Glossary.

Building site development

The degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, and local roads and streets are indicated in table 8. A *slight* limitation indicates that soil properties generally are favorable for the specified use; any limitation is minor and easily overcome. A *moderate* limitation indicates that soil properties and site features are unfavorable for the specified use, but the limitations can be overcome or minimized by special planning and design. A *severe* limitation indicates that one or more soil properties or site features are so unfavorable or difficult to overcome that a major increase in construction effort, special design, or intensive maintenance is required. For some soils rated severe, such costly measures may not be feasible.

Shallow excavations are made for pipelines, sewerlines, communications and power transmission lines, basements, open ditches, and cemeteries. Such digging or trenching is influenced by soil wetness caused by a seasonal high water table; the texture and consistence of soils; the tendency of soils to cave in or slough; and the presence of very firm, dense soil layers, bedrock, or large stones. In addition, excavations are affected by slope of the soil and the probability of flooding. Ratings do not apply to soil horizons below a depth of 6 feet unless otherwise noted.

In the soil series descriptions, the consistence of each soil horizon is given, and the presence of very firm or extremely firm horizons, usually difficult to excavate, is indicated.

Dwellings and *small commercial buildings* referred to in table 8 are built on undisturbed soil and have foundation loads of a dwelling no more than three stories high. Separate ratings are made for small commercial buildings without basements and for dwellings with and without basements. For such structures, soils should be sufficiently stable that cracking or subsidence of the structure from settling or shear failure of the foundation does not occur. These ratings were determined from estimates of the shear strength, compressibility, and shrink-swell potential of the soil. Soil texture, plasticity and in-place density, potential frost action, soil wetness, and depth to a seasonal high water table were also considered. Soil wetness and depth to a seasonal high water table indicate potential difficulty in providing adequate drainage for basements, lawns, and gardens. Depth to bedrock, slope, and large stones in or on the soil are also important considerations in the choice of sites for these structures and were considered in determining the ratings. Susceptibility to flooding is a serious hazard.

Local roads and streets referred to in table 8 have an all-weather surface that can carry light to medium traffic all year. They consist of a subgrade of the underlying soil material; a base of gravel, crushed rock fragments, or soil material stabilized with lime or cement; and a flexible or rigid surface, commonly asphalt or concrete. The roads are graded with soil material at hand, and most cuts and fills are less than 6 feet deep.

The load supporting capacity and the stability of the soil as well as the quantity and workability of fill material available are important in design and construction of roads and streets. The classifications of the soil and the soil texture, density, shrink-swell potential, and potential frost action are indicators of the traffic supporting capacity used in making the ratings. Soil wetness, flooding, slope, depth to hard rock or very compact layers, and content of large stones affect stability and ease of excavation.

Sanitary facilities

Favorable soil properties and site features are needed for proper functioning of septic tank absorption fields, sewage lagoons, and sanitary landfills. The nature of the soil is important in selecting sites for these facilities and in identifying limiting soil properties and site features to be considered in design and installation. Also, those soil properties that affect ease of excavation or installation of these facilities will be of interest to contractors and local officials. Table 9 shows the degree and kind of limitations of each soil for such uses and for use of the soil as daily cover for landfills. It is important to observe local ordinances and regulations.

If the degree of soil limitation is expressed as *slight,* soils are generally favorable for the specified use and limitations are minor and easily overcome; if *moderate,* soil properties or site features are unfavorable for the specified use, but limitations can be overcome by special planning and design; and if *severe, soil* properties or site features are so unfavorable or difficult to overcome that major soil reclamation, special designs, or intensive maintenance is required. Soil suitability is rated by the terms *good, fair,* or *poor,* which, respectively, mean about the same as the terms *slight, moderate,* and *severe.*

Septic tank absorption fields are subsurface systems of tile or perforated pipe that distributes effluent from a septic tank into the natural soil. Only the soil horizons between depths of 18 and 72 inches are evaluated for this use. The soil properties and site features considered are those that affect the absorption of the effluent and those that affect the construction of the system.

Properties and features that affect absorption of the effluent are permeability, depth to seasonal high water table, depth to bedrock, and susceptibility to flooding.

Stones, boulders, and shallowness to bedrock interfere with installation. Excessive slope can cause lateral seepage and surfacing of the effluent. Also, soil erosion and soil slippage are hazards if absorption fields are installed on sloping soils.

In some soils, loose sand and gravel or fractured bedrock is less than 4 feet below the tile lines. In these soils the absorption field does not adequately filter the effluent, and ground water in the area may be contaminated.

On many of the soils that have moderate or severe limitations for use as septic tank absorption fields, a system to lower the seasonal water table can be installed or the size of the absorption field can be increased so that performance is satisfactory.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons have a nearly level floor and cut slopes or embankments of compacted soil material. Aerobic lagoons generally are designed to hold 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. Soils that are very high in content of organic matter and those that have cobbles, stones, or boulders are not suitable. Unless the soil has very slow permeability, contamination of ground water is a hazard where the seasonal high water table is above the level of the lagoon floor. In soils where the water table is seasonally high, seepage of ground water into the lagoon can seriously reduce the lagoon's capacity for liquid waste. Slope, depth to bedrock, and susceptibility to flooding also affect the suitability of sites for sewage lagoons or the cost of construction. Shear strength and permeability of compacted soil material affect the performance of embankments.

Sanitary landfill is a method of disposing of solid waste by placing refuse in successive layers either in excavated trenches or on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil material. Landfill areas are subject to heavy vehicular traffic. Risk of polluting ground water and trafficability affect the suitability of a soil for this use. The best soils have a loamy or silty texture, have moderate to slow permeability, are deep to a seasonal water table, and are not subject to flooding. Clayey soils are likely to be sticky and difficult to spread. Sandy or gravelly soils generally have rapid permeability, which might allow noxious liquids to contaminate ground water. Soil wetness can be a limitation, because operating heavy equipment on a wet soil is difficult. Seepage into the refuse increases the risk of pollution of ground water.

Ease of excavation affects the suitability of a soil for the trench type of landfill. A suitable soil is deep to bedrock and free of large stones and boulders. If the seasonal water table is high, water will seep into trenches.

Unless otherwise stated, the limitations in table 9 apply only to the soil material within a depth of about 6 feet. If the trench is deeper, a limitation of slight or moderate may not be valid. Site investigation is needed before a site is selected.

Daily cover for landfill should be soil that is easy to excavate and spread over the compacted fill in wet and dry periods. Soils that are loamy or silty and free of stones or boulders are better than other soils. Clayey soils may be sticky and difficult to spread; sandy soils may be subject to soil blowing.

The soils selected for final cover of landfills should be suitable for growing plants. Of all the horizons, the A horizon in most soils has the best workability, more organic matter, and the best potential for growing plants. Thus, for either the area- or trench-type landfill, stockpiling material from the A horizon for use as the surface layer of the final cover is desirable.

Where it is necessary to bring in soil material for daily or final cover, thickness of suitable soil material available and depth to a seasonal high water table in soils surrounding the sites should be evaluated. Other factors to be evaluated are those that affect reclamation of the borrow areas. These factors include slope, erodibility, and potential for plant growth.

Construction materials

The suitability of each soil as a source of roadfill, sand, gravel, and topsoil is indicated in table 10 by ratings of good, fair, or poor. The texture, thickness, and organic-matter content of each soil horizon are important factors in rating soils for use as construction materials. Each soil is evaluated to the depth observed, generally about 6 feet.

Roadfill is soil material used in embankments for roads. Soils are evaluated as a source of roadfill for low embankments, which generally are less than 6 feet high and less exacting in design than high embankments. The ratings reflect the ease of excavating and working the material and the expected performance of the material where it has been compacted and adequately drained. The performance of soil after it is stabilized with lime or cement is not considered in the ratings, but information about some of the soil properties that influence such performance is given in the descriptions of the soil series.

The ratings apply to the soil material between the A horizon and a depth of 5 to 6 feet. It is assumed that soil horizons will be mixed during excavation and spreading. Many soils have horizons of contrasting suitability within their profile. The estimated engineering properties in table 14 provide specific information about the nature of each horizon. This information can help determine the suitability of each horizon for roadfill.

Soils rated *good* are coarse grained. They have low shrink-swell potential, low potential frost action, and few cobbles and stones. They are at least moderately well drained and have slopes of 15 percent or less. Soils rated *fair* have a plasticity index of less than 15 and have other limiting features, such as moderate shrink-swell potential, moderately steep slopes, wetness, or many stones. If the thickness of suitable material is less than 3 feet, the entire soil is rated *poor.*

Sand and *gravel* are used in great quantities in many kinds of construction. The ratings in table 10 provide guidance as to where to look for probable sources and are based on the probability that soils in a given area contain sizable quantities of sand or gravel. A soil rated *good* or *fair* has a layer of suitable material at least 3 feet thick, the top of which is within a depth of 6 feet. Coarse fragments of soft bedrock material, such as shale and siltstone, are not considered to be sand and gravel. Fine-grained soils are not suitable sources of sand and gravel.

The ratings do not take into account depth to the water table or other factors that affect excavation of the material. Descriptions of grain size, kinds of minerals, reaction, and stratification are given in the soil series descriptions and in table 14.

Topsoil is used in areas where vegetation is to be established and maintained. Suitability is affected mainly by the ease of working and spreading the soil material in preparing a seedbed and by the ability of the soil material to support plantlife. Also considered is the damage that can result at the area from which the topsoil is taken.

The ease of excavation is influenced by the thickness of suitable material, wetness, slope, and amount of stones. The ability of the soil to support plantlife is determined by texture, structure, and the amount of soluble salts or toxic substances. Organic matter in the Al or Ap horizon greatly increases the absorption and retention of moisture and nutrients. Therefore, the soil material from these horizons should be carefully preserved for later use.

Soils rated *good* have at least 16 inches of friable loamy material at their surface. They are free of stones and cobbles, are low in content of gravel, and have gentle slopes. They are low in soluble salts that can limit or prevent plant growth. They are naturally fertile or respond well to fertilizer. They are not so wet that excavation is difficult during most of the year.

Soils rated *fair* are loose sandy soils or firm loamy or clayey soils in which the suitable material is only 8 to 16 inches thick or soils that have appreciable amounts of gravel, stones, or soluble salt.

Soils rated *poor* are very sandy soils and very firm clayey soils; soils with suitable layers less than 8 inches thick; soils having large amounts of gravel, stones, or soluble salt; steep soils; and poorly drained soils.

Although a rating of *good* is not based entirely on high content of organic matter, a surface horizon is generally preferred for topsoil because of its organic-matter content. This horizon is designated as Al or Ap in the soil series descriptions. The absorption and retention of moisture and nutrients for plant growth are greatly increased by organic matter.

Water management

Many soil properties and site features that affect water management practices have been identified in this soil survey. In table 11 soil and site features that affect use are indicated for each kind of soil. This information is significant in planning, installing, and maintaining water control structures.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have a low seepage potential, which is determined by permeability and the depth to fractured or permeable bedrock or other permeable material.

Embankments, dikes, and levees require soil material that is resistant to seepage, erosion, and piping and has favorable stability, shrink-swell potential, shear strength, and compaction characteristics. Large stones and organic matter in a soil downgrade the suitability of a soil for use in embankments, dikes, and levees.

Aquifer fed excavated ponds are bodies of water made by excavating a pit or dugout into a ground-water aquifer. Excluded are ponds that are fed by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Soil properties and site features that affect aquifer-fed ponds are depth to a permanent water table, permeability of the aquifer, quality of the water, and ease of excavation.

Drainage of soil is affected by such soil properties as permeability; texture; depth to bedrock, hardpan, or other layers that affect the rate of water movement; depth to the water table; slope; stability of ditchbanks; susceptibility to flooding; salinity and alkalinity; and availability of outlets for drainage.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to intercept runoff. They allow water to soak into the soil or flow slowly to an outlet. Features that affect suitability of a soil for terraces are uniformity and steepness of slope; depth to bedrock, hardpan, or other unfavorable material; large stones; permeability; ease of establishing vegetation; and resistance to water erosion, soil blowing, soil slipping, and piping.

Grassed waterways are constructed to channel runoff to outlets at a nonerosive velocity. Features that affect the use of soils for waterways are slope, permeability, erodibility, wetness, and suitability for permanent vegetation.

Recreation

Opportunities are abundant in the area for outdoor recreation. Camping, hiking, hunting, fishing, boating, and nature study are popular recreational activities.

The soils of the survey area are rated in table 12 according to limitations that affect their suitability for recreation uses. The ratings are based on such restrictive soil features as flooding, wetness, slope, and texture of the surface layer. Not considered in these ratings, but important in evaluating a site, are location and accessibility of the area, size and shape of the area and its scenic quality, the ability of the soil to support vegetation, access to water, potential water impoundment sites available, and either access to public sewerlines or capacity of the soil to absorb septic tank effluent. Soils subject to flooding are limited, in varying degree, for recreation use by the duration and intensity of flooding and the season when flooding occurs. Onsite assessment of height, duration, intensity, and frequency of flooding is essential in planning recreation facilities.

The degree of the limitation of the soils is expressed as slight, moderate, or severe. *Slight* means that the soil properties are generally favorable and that the limitations are minor and easily overcome. *Moderate* means that the 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 12 can be supplemented by information in other parts of this survey. Especially helpful are interpretations for septic tank absorption fields, given in table 9, and interpretations for dwellings without basements and for local roads and streets, given in table 8.

Camp areas require such site preparation as shaping and leveling for 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 for this use have mild slopes 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 camping sites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for use as 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 will 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 or boulders, is firm after rains, and is not dusty when dry. If shaping is required to obtain a uniform grade, the depth of the soil over bedrock or hardpan should be enough to allow necessary grading.

Paths and trails for walking, horseback riding, bicycling, and other uses should require little or no cutting and filling. The best soils for this use are those that are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once during the annual period of use. They should have moderate slopes and have few or no stones or boulders on the surface.

Wildlife habitat

CLYDE SCOTT, biologist, Soil Conservation Service, helped prepare this section

Soils directly affect the kind and amount of vegetation that is available to wildlife as food and cover, and they affect the construction of water impoundments. The kind and abundance of wildlife that populate an area depend largely on the amount and distribution of food, cover, and water. If any one of these elements is missing, is inadequate, or is inaccessible, wildlife either are scarce or do not inhabit the area.

If the soils have the potential, wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by helping the natural establishment of desirable plants.

In table 13, the soils in the survey area are rated according to their potential to support the main kinds of wildlife habitat in the area. This information can be used in planning for parks, wildlife refuges, nature study areas, and other developments for wildlife; selecting areas that are suitable for wildlife; selecting soils that are suitable for creating, improving, or maintaining specific elements of wildlife habitat; and determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* means that the element of wildlife habitat or the kind of habitat is easily created, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected if the soil is used for the designated purpose. A rating of *fair* means that the element of wildlife habitat or kind of habitat can be created, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* means that limitations are severe for the designated element or kind of wildlife habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* means that restrictions for the element of wildlife habitat or kind of wildlife are very severe, and that unsatisfactory results can be expected. Wildlife habitat is impractical or even impossible to create, improve, or maintain on soils having such a rating.

The elements of wildlife habitat are briefly described in the following paragraphs.

Grain and seed crops are seed-producing annuals used by wildlife. The major soil properties that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes that are planted for wildlife food and cover. Major soil properties that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, lovegrass, bromegrass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds, that provide food and cover for wildlife. Major soil properties that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are blue wildrye, pine reedgrass, bluebunch wheatgrass, elk sedge, hawkweed, Sandberg peavine, and geranium.

Coniferous plants are cone-bearing trees, shrubs, or ground cover plants that furnish habitat or supply food in the form of browse, seeds, or fruitlike cones. Soil properties that have a major effect on the growth of coniferous plants are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, spruce, fir, cedar, and juniper.

Shrubs are bushy woody plants that produce fruit, buds, twigs, bark, or foliage used by wildlife or that provide cover and shade for some species of wildlife. Major soil properties that affect the growth of shrubs are depth of the root zone, available water capacity, salinity, and moisture. Examples of shrubs are red-stem ceanothus, baldhip rose, snowberry, and mountain blueberry.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites, exclusive of submerged or floating aquatics. They produce food or cover for wildlife that use wetland as habitat. Major soil properties affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, wildrice, saltgrass, and cordgrass and rushes, sedges, and reeds.

Shallow water areas are bodies of water that have an average depth of less than 5 feet and that are useful to wildlife. They can be naturally wet areas, or they can be created by dams or levees or by water-control structures in marshes or streams. Major soil properties affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. The availability of a dependable water supply is important if water areas are to be developed. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The kinds of wildlife habitat are briefly described in the following paragraphs.

Openland habitat consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The kinds of wildlife attracted to these areas include Hungarian partridge, pheasant, meadowlark, mourning dove, field sparrow, cottontail rabbit, skunk, and woodchuck.

Woodland habitat consists of areas of hardwoods or conifers, or a mixture of both, and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include ruffed grouse, woodcock, thrushes, woodpeckers, squirrels, gray fox, raccoon, deer, elk, and bear.

Wetland habitat consists of open, marshy or swampy, shallow water areas where water-tolerant plants grow. Some of the wildlife attracted to such areas are ducks, geese, shore birds, muskrat, mink, and beaver.

Rangeland habitat consists of areas of wild herbaceous plants and shrubs. Wildlife attracted to rangeland include mule deer, bobcat, quail, meadowlark, coyote, chukar, and lark bunting.

Soil properties

Extensive data about soil properties are summarized on the following pages. The two main sources of these data are the many thousands of soil borings made during the course of the survey and the laboratory analyses of selected soil samples from typical profiles.

In making soil borings during field mapping, soil scientists can identify several important soil properties. They note the seasonal soil moisture condition or the presence of free water and its depth. For each horizon in the profile, they note the thickness and color of the soil material; the texture, or amount of clay, silt, sand, and gravel or other coarse fragments; the structure, or the natural pattern of cracks and pores in the undisturbed soil; and the consistence of the soil material in place under the existing soil moisture conditions. They record the depth of plant roots, determine the pH or reaction of the soil, and identify any free carbonates.

Samples of soil material are analyzed in the laboratory to verify the field estimates of soil properties and to determine all major properties of key soils, especially properties that cannot be estimated accurately by field observation. Laboratory analyses are not conducted for all soil series in the survey area, but laboratory data for many soil series not tested are available from nearby survey areas.

The available field and laboratory data are summarized in tables. The tables give the estimated range of engineering properties, the engineering classifications, and the physical and chemical properties of each major horizon of each soil in the survey area. They also present data about pertinent soil and water features, engineering test data, and data obtained from physical and chemical laboratory analyses of soils.

Engineering properties

Table 14 gives estimates of engineering properties and classifications for the major horizons of each soil in the survey area.

Most soils have, within the upper 5 or 6 feet, horizons of contrasting properties. Table 14 gives information for each of these contrasting horizons in a typical profile. *Depth* to the upper and lower boundaries of each horizon is indicated. More information about the range in depth and about other properties in each horizon is given for each soil series in the section "Soil series and morphology."

Texture is described in table 14 in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in soil material that is less than 2 millimeters in diameter. "Loam," for example, is soil material that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains gravel or other particles coarser than sand, an appropriate modifier is added, for example, "gravelly loam." Other texture terms are defined in the Glossary.

The two systems commonly used in classifying soils for engineering use are the Unified Soil Classification System (Unified) (2) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO) (1).

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, plasticity index, liquid limit, and organic-matter content. Soils are grouped into 15 classes-eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes have a dual classification symbol, for example, CL-ML.

The *AASHTO* system classifies soils according to those properties that affect their use in highway construction and maintenance. In this system a mineral soil is classified in one of seven basic groups ranging 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. At the other extreme, in group A-7, are fine-grained soils. Highly organic soils are classified in group A-8 on the basis of visual inspection.

When laboratory data are available, the A-1, A-2, and A-7 groups are further classified as follows: A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, and A-7-6. As an additional refinement, the desirability of soils as subgrade material can be indicated by a group index number. These numbers range from 0 for the best subgrade material to 20 or higher for the poorest. The estimated classification, without group index numbers, is given in table 14. Also in table 14 the percentage, by weight, of rock fragments more than 3 inches in diameter is estimated for each major horizon. These estimates are determined mainly by observing volume percentage in the field and then converting that, by formula, to weight percentage.

Percentage of the soil material less than 3 inches in diameter that passes each of four sieves (U.S. standard) is estimated for each major horizon. The estimates are based on tests of soils that were sampled in the survey area and in nearby areas and on field estimates from many borings made during the survey.

Liquid limit and *plasticity index* indicate the effect of water on the strength and consistence of soil. These indexes are used in both the Unified and AASHTO soil classification systems (6). They are also used as indicators in making general predictions of soil behavior. Range in liquid limit and plasticity index are estimated on the basis of test data from the survey area or from nearby areas and on observations of the many soil borings made during the survey.

All of the estimates in table 14 have been rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount across classification boundaries (1 or 2 percent), the classification in the marginal zone is omitted.

Physical and Chemical Properties

Table 15 shows estimated values for several soil characteristics and features that affect behavior of soils in engineering uses. These estimates are given for each major horizon, at the depths indicated, in the typical pedon of each soil. The estimates are based on field observations and on test data for these and similar soils.

Permeability is estimated on the basis of known relationships among the soil characteristics observed in the field-particularly soil structure, porosity, and gradation or texture-that influence the downward movement of water in the soil. The estimates are for vertical water movement when the soil is saturated. Not considered in the estimates is lateral seepage or such transient soil features as plowpans and surface crusts. Permeability of the soil is an important factor to be considered in planning and designing drainage systems, in evaluating the potential of soils for septic tank systems and other waste disposal systems, and in many other aspects of land use and management.

Available water capacity is rated on the basis of soil characteristics that influence the ability of the soil to hold water and make it available to plants. Important characteristics are content of organic matter, soil texture, and soil structure. Shallow-rooted plants are not likely to use the available water from the deeper soil horizons. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design of irrigation systems.

Soil reaction is expressed as range in pH values. The range in pH of each major horizon is based on many field checks. For many soils, the values have been verified by laboratory analyses. Soil reaction is important in selecting the crops, ornamental plants, or other plants to be grown; in evaluating soil amendments for fertility and stabilization; and in evaluating the corrosivity of soils.

Shrink-swell potential depends mainly on the amount and kind of clay in the soil. Laboratory measurements of the swelling of undisturbed clods were made for many soils. For others the swelling was estimated on the basis of the kind and amount of clay in the soil and on measurements of similar soils. The size of the load and the magnitude of the change in soil moisture content also influence the swelling of soils. Shrinking and swelling of some soils can cause damage to building foundations, basement walls, roads, and other structures unless special designs are used. A high shrink-swell potential indicates that special design and added expense may be required if the planned use of the soil will not tolerate large volume changes.

Risk of corrosion pertains to potential soil-induced chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to soil moisture, particle-size distribution, total acidity, and electrical conductivity of the soil material. The rate of corrosion of concrete is based mainly on the sulfate content, texture, and acidity of the soil. Protective measures for steel or more resistant concrete help to avoid or minimize damage resulting from the corrosion. Uncoated steel intersecting soil boundaries or soil horizons is more susceptible to corrosion than an installation that is entirely within one kind of soil or within one soil horizon.

Erosion factors are used to predict the erodibility of a soil and its tolerance to erosion in relation to specific kinds of land use and treatment. The soil erodibility factor (K) is a measure of the susceptibility of the soil to erosion by water. Soils having the highest K values are the most erodible. K values range from 0.10 to 0.64. To estimate annual soil loss per acre, the K value of a soil is modified by factors representing plant cover, grade and length of slope, management practices, and climate. The soil-loss tolerance factor (T) is the maximum rate of soil erosion, whether from rainfall or soil blowing, that can occur without reducing crop production or environmental quality. The rate is expressed in tons of soil loss per acre per year.

Wind erodibility groups are made up of soils that have similar properties that affect their resistance to soilblowing if cultivated. The groups are used to predict the susceptibility of soil to blowing and the amount of soil lost as a result of blowing. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are extremely erodible, so vegetation is difficult to establish. They are generally not suitable for crops.

2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible, but crops can be grown if intensive measures to control soil blowing are used.

3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible, but crops can be grown if intensive measures to control soil blowing 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, but crops can be grown if intensive measures to control soil blowing are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible, but crops can be grown if measures to control soil blowing are used.

5. Loamy soils that are less than 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible, but crops can be grown if measures to control soil blowing are used.

6. Loamy soils that are 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible, and crops can easily be grown.

7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible, and crops can easily be grown.

8. Stony or gravelly soils and other soils not subject to soil blowing.

Soil and water features

Table 16 contains information helpful in planning land uses and engineering projects that are likely to be affected by soil and water features.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are placed in one of four groups on the basis of the intake of water after the soils have been wetted and have received 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 chiefly of deep, well drained to excessively drained sands or gravels. 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 that have a layer that impedes the downward movement of water or soils that have 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 soils that have a 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 is the temporary covering of soil with water .from overflowing streams, with runoff from adjacent slopes, and by tides. Water standing for short periods after rains or after snow melts is not considered flooding, nor is water in swamps and marshes. Flooding is rated in general terms that describe the frequency and duration of flooding and the time of year when flooding is most likely. The ratings are based on evidence in the soil profile of the effects of flooding, namely thin strata of gravel, sand, silt, or, in places, clay deposited by floodwater; irregular decrease in organic-matter content with increasing depth; and absence of distinctive soil horizons that form in soils of the area that are not subject to flooding. The ratings are also based on local information about floodwater levels in the area and the extent of flooding and on information that relates the position of each soil on the landscape to historic floods.

The generalized description of flood hazards is of value in land-use planning and provides a valid basis for land use restrictions. The soil data are less specific, however, than those provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table is the highest level of a saturated zone more than 6 inches thick for a continuous period of more than 2 weeks during most years. The depth to a seasonal high water table applies to undrained soils. Estimates are based mainly on the relationship between grayish colors or mottles in the soil and the depth to free water observed in many borings made during the course of the soil survey. 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 commonly is high. Only saturated zones above a depth of 5 or 6 feet are indicated.

Information about the seasonal high water table helps in assessing the need for specially designed foundations, the need for specific kinds of drainage systems, and the need for footing drains to insure dry basements. Such information is also needed to decide whether or not construction of basements is feasible and to determine how septic tank absorption fields and other underground installations will function. Also, a seasonal high water table affects ease of excavation.

Depth to bedrock is shown for all soils that are underlain by bedrock at a depth of 5 to 6 feet or less. For many soils, the limited depth to bedrock is a part of the definition of the soil series. The depths shown are based on measurements made in many soil borings and on other observations during the mapping of the soils. The kind of bedrock and its hardness as related to ease of excavation is also shown. Rippable bedrock can be excavated with a single-tooth ripping attachment on a 200-horsepower tractor, but hard bedrock generally requires blasting.

Potential frost action refers to the likelihood of damage to pavements and other structures by frost heaving and low soil strength after thawing. Frost action results from the movement of soil moisture into the freezing temperature zone in the soil, which causes ice lenses to form. Soil texture, temperature, moisture content, porosity, permeability, and content of organic matter are the most important soil properties that affect frost action. It is assumed that the soil is not covered by insulating vegetation or snow and is not artificially drained. Silty and clayey soils that have a high water table in winter are most susceptible to frost action. Well drained very gravelly or sandy soils are the least susceptible.

Classification of the soils

The system of soil classification currently used was adopted by the National Cooperative Soil Survey in 1965. Readers interested in further details about the system should refer to "Soil taxonomy" (10).

The system of classification has six categories. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. In this system the classification is based on the different soil properties that can be observed in the field or those that can be inferred either from other properties that are observable in the field or from the combined data of soil science and other disciplines. The properties selected for the higher categories are the result of soil genesis or of factors that affect soil genesis. In table 17, the soils of the survey area are classified according to the system. Categories of the system are discussed in the following paragraphs.

ORDER. Ten soil orders are recognized as classes in the system. The properties used to differentiate among orders are those that reflect the kind and degree of dominant soil-forming processes that have taken place. Each order is identified by a word ending in *sol.* An example is Inceptisol.

SUBORDER. Each order is divided into suborders based primarily on properties that influence soil genesis and are important to plant growth or that are selected to reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Aquept *(Aqu,* meaning water, plus *ept,* from Inceptisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of expression of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and a prefix that suggests something about the properties of the soil. An example is Haplaquepts *(Hapl,* meaning simple horizons, plus *aquept,* the suborder of Inceptisols that have an aquic moisture regime).

SUBGROUP. Each great group may be divided into three subgroups: the central (typic) concept of the great groups, which is not necessarily the most extensive subgroup; the intergrades, or transitional forms to other orders, suborders, or great groups; and the extragrades, which have some properties that are representative of the great groups 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 is thought to typify the great group. An example is Typic Haplaquepts.

FAMILY. Families are established within a subgroup on the basis of similar physical and chemical properties that affect management. Among the properties considered in horizons of major biological activity below plow depth are particle-size distribution, mineral content, temperature regime, thickness of the soil penetrable by roots, consistence, moisture equivalent, soil slope, and permanent cracks. A family name consists of the name of a subgroup and a series of adjectives. The adjectives are the class names for the soil properties used as family differentiae. An example is coarse-silty, mixed, nonacid, frigid, Typic Haplaquepts.

SERIES. The series consists of soils that formed in a particular kind of material and have horizons that, except for texture of the surface soil or of the underlying substratum, are similar in differentiating characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineral and chemical composition. Ramsdell is an example of a series name.

Soil series and morphology

In this section, each soil series recognized in the survey area is described in detail. The descriptions are arranged in alphabetic order by series name.

Characteristics of the soil and the material in which it formed are discussed for each series. The soil is then compared to similar soils and to nearby soils of other series. Then a pedon, a small three-dimensional area of soil that is typical of the soil series in the survey area, is described. The detailed descriptions of each soil horizon follow standards in the Soil Survey Manual (7). Unless otherwise noted, colors described are for moist soil.

Following the pedon description is the range of important characteristics of the soil series in this survey area. Phases, or mapping units, of each soil series are described in the section "Soil maps for detailed planning."

Ardenvoir series

The Ardenvoir series consists of deep, well drained soils that formed in material weathered from metasedimentary bedrock with a mixture of loess and volcanic ash. These soils are on mountains. They have slopes of 20 to 65 percent. The mean annual precipitation is about 29 inches, and mean annual air temperature is about 42 degrees F. Mean annual soil temperature is 41 to 47 degrees.

Ardenvoir soils are similar to the Blinn and Divers soils and are near the Huckleberry, McCrosket, and Tekoa soils. Blinn soils have fractured basalt at a depth of 20 to 40 inches. Divers soils have colder soil temperatures, contain more volcanic ash, and have a bulk density in the upper 30 inches of less than 0.95 grams per centimeter. Huckleberry soils have weathered shale at a depth of 20 to 40 inches and a bulk density to a depth of 14 inches or more of less than 0.85 grams per centimeter. McCrosket and Tekoa soils have a mean annual soil temperature of more than 47 degrees.

Typical pedon of Ardenvoir gravelly loam, 220 feet west and 740 feet south of the northeast corner of sec. 2, T. 43 N., R. 5 W.:

O1-2 inches to 1 inch; decomposed needles and twigs; 0 to 2 inches thick.

O2-1 inch to 0; undecomposed needles and twigs; 0 to 1.5 inches thick.

A11-0 to 4 inches; brown (10YR 5/3) gravelly loam, dark yellowish brown (10YR 3/4) moist; weak very fine and fine granular structure; soft, very friable, nonsticky and nonplastic; many fine and medium and few coarse roots; many fine interstitial pores; 20 percent gravel; neutral (pH 6.6); clear wavy boundary; 2 to 5 inches thick.

A12-4 to 9 inches; light yellowish brown (10YR 6/4) gravelly loam, dark yellowish brown (10YR 4/4) moist; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine, medium, and coarse roots; many very fine and fine tubular pores; 20 percent gravel; slightly acid (pH 6.4); gradual wavy boundary; 4 to 6 inches thick.

B2-9 to 17 inches; very pale brown (10YR 7/4) gravelly loam, yellowish brown (10YR 5/4) moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few fine to coarse roots; many very fine and fine tubular pores; 20 percent gravel; slightly acid (pH 62); gradual wavy boundary; 8 to 12 inches thick.

C1-17 to 37 inches; very pale brown (10YR 7/4) very cobbly loam, yellowish brown (10YR 5/4) moist; weak medium and coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few fine, medium, and coarse roots; common very fine and fine tubular and interstitial pores; 40 percent coarse fragments; medium acid (pH 5.6); gradual wavy boundary; 18 to 22 inches thick.

C2-37 to 46 inches; very pale brown (10YR 7/3) very flaggy loam, light yellowish brown (10YR 6/4) moist; weak medium and coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few fine and medium roots; few very fine and fine tubular pores; 80 percent gravel, cobbles, stones; medium acid (pH 6.0); gradual wavy boundary; 8 to 15 inches thick

Cr3-46 inches; weathered metasedimentary bedrock.

Depth to weathered metasedimentary bedrock is 40 to 60 inches. The solum is 14 to 24 inches thick.

Gravel content of the A horizon ranges from 15 to 25 percent. The B2 horizon has value of 6 or 7 dry and 4 or 5 moist and chroma of 3 or 4. Coarse fragments make up 15 to 25 percent of this horizon. The C horizon ranges from very gravelly loam to very flaggy loam. Coarse fragments make up 35 to 90 percent of this horizon.

Benewah series

The Benewah series consists of very deep, moderately well drained soils that formed in loess and material derived from mud flows. These soils are on mountain foot slopes. They have slopes of 5 to 35 percent. The mean annual precipitation is about 28 inches, and mean annual air temperature is about 43 degrees F. Mean annual soil temperature is 44 to 46 degrees.

Benewah soils are similar to the Lovell and Moctileme soils and are near the Rasser and Santa soils. Lovell and Moctileme soils are somewhat poorly drained soils on alluvial bottom lands and low terraces and have slopes of 0 to 2 percent. Rasser soils have a very cobbly and very gravelly clay loam B horizon. Santa soils have a fragipan.

Typical pedon of Benewah silt loam, 5 to 20 percent slopes, about 0.3 mile south of Benewah in SW1/4SW1/4 sec. 24, T. 45 N., R. 4 W.:

Ap-0 to 6 inches; light brownish gray (10YR 6/2) silt loam, dark brown (10YR 3/3) moist; weak fine and medium granular structure; hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; medium acid (pH 6.0); abrupt wavy boundary; 4 to 6 inches thick.

A21-6 to 15 inches; light yellowish brown (10YR 6/4) silt loam, dark yellowish brown (10YR 4/4) moist; moderate fine subangular blocky structure; very hard, friable, slightly sticky and slightly plastic; few fine and common very fine roots; common very fine and fine tubular pores; many very fine and fine black concretions; 5 percent cobbles; strongly acid (pH 5.5); clear wavy boundary; 7 to 11 inches thick

A22-15 to 18 inches; very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) moist; moderate coarse subangular blocky structure; very hard, friable, sticky and plastic; few very fine and fine roots; common very fine and fine tubular pores; common very fine and fine black concretions; strongly acid (pH 5.1); abrupt wavy boundary; 3 to 6 inches thick.

B21t-18 to 23 inches; brown (7.5YR 5/4) silty clay loam, dark brown (7.5YR 4/4) moist; moderate coarse columnar structure; extremely hard, firm, sticky and plastic; few very fine and fine roots; common very fine and fine tubular pores; thin continuous clay films on peds; common very fine and fine black concretions; 5 percent fine gravel; 80 percent of ped surfaces are coated with material from the A2 horizon; strongly acid (pH 5.4); clear wavy boundary; 5 to 10 inches thick.

B22t-23 to 34 inches; brown (7.5YR 4/4) silty clay loam, dark reddish brown (5YR 3/4) moist; moderate coarse prismatic structure; extremely hard, very firm, sticky and plastic; few very fine and fine roots; common very fine and fine tubular pores; thin continuous clay films on peds; common very fine and fine black concretions; some splotches of black stains; 5 percent fine gravel; 40 percent of ped surfaces are coated with material from the A2 horizon; medium acid (pH 5.7); clear wavy boundary; 9 to 15 inches thick

B23t-34 to 60 inches; brown (7.5YR 5/4) silty clay loam, reddish brown (5YR 4/4) moist; moderate coarse prismatic structure; extremely hard, very firm, sticky and plastic; common very fine and fine tubular pores; thick continuous clay films on faces of peds; common very fine, fine, and medium black concretions; very strongly acid (pH 4.5).

An 0 horizon, 1 to 2.5 inches thick, is present if the soil has not been disturbed. The upper boundary of the B2t horizon ranges from 14 to 23 inches below the surface. The Ap horizon has value of 5 or 6 dry and 3 or 4 moist and chroma of 2 or 3 dry and moist. The A2 horizon has value of 6 to 8 dry and 4 to 6 moist and chroma of 3 or 4 dry and moist. The B2t horizon has hue of 7.5YR or 5YR, value of 4 to 6 dry and 3 or 4 moist and chroma of 3 or 4 dry and moist. The B2t horizon is 5 percent fine gravel.

Blinn series

The Blinn series consists of moderately deep, well drained soils that formed in basalt colluvium with a thin mantle of loess and volcanic ash. These soils are on escarpments and foot slopes. They have slopes of 5 to 65 percent. The mean annual precipitation is about 26 inches, and mean annual air temperature is about 43 degrees F. Mean annual soil temperature is 44 to 46 degrees.

Blinn soils are similar to the Ardenvoir, Divers, and Huckleberry soils and are near the Bobbitt, Lacy, and Santa soils. Ardenvoir soils have metasedimentary bedrock at a depth of 40 to 60 inches. Divers soils contain more volcanic ash and have a bulk density in the upper 30 inches of less than 0.95 grams per centimeter. Huckleberry soils have a bulk density to a depth of 14 inches or more of less than 0.85 grams per centimeter. Bobbitt soils have a mean annual soil temperature of more than 47 degrees. Lacy soils have basalt at a depth of 10 to 20 inches and a mean annual soil temperature of more than 47 degrees. Santa soils do not have coarse fragments and have a fragipan.

Typical pedon of Blinn stony loam, 35 to 65 percent slopes, about 1,800 feet south and 510 feet west of the northeast corner of see. 7. T. 46 N., R. 3 W.:

O1-1.4 inches to 0.5 inch; needles and twigs.

O2-0.5 inch to 0; partly decomposed needles and twigs.

A11-0 to 4 inches; light brownish gray (10YR 6/2) stony loam, dark brown (10YR 3/3) moist; weak very thin and thin platy structure parting to weak very fine, and fine granular; soft, very friable; nonsticky and nonplastic; many very fine, fine and medium roots; many very fine and fine tubular pores; 10 percent basalt gravel, cobbles, and stones; neutral (pH 7.2); clear smooth boundary; 3 to 4 inches thick

A12-4 to 10 inches; pale brown (10YR 6/3) stony loam, brown (10YR 4/3) moist; weak fine and medium subangular blocky structure; slightly hard, friable; nonsticky and nonplastic; many very fine, fine, and medium roots; many very fine and fine tubular pores; about 10 percent basalt gravel, cobbles, and stones; neutral (pH 7.0); gradual smooth boundary; 4 to 6 inches thick

B2-10 to 22 inches; pale brown (10YR 6/3) stony loam, brown (10YR 4/3) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, firm, slightly sticky and nonplastic; common fine and medium roots; common very fine and fine tubular pores; about 20 percent basalt gravel, cobbles, and stones; neutral (pH 72); gradual smooth boundary; 8 to 13 inches thick

C1-22 to 39 inches; pale brown (10YR 6/3) very stony loam, brown (10YR 5/3) moist; weak medium and coarse subangular blocky structure; hard, firm, slightly sticky and slightly plastic; few fine and medium roots; few very fine and fine tubular pores; about 50 percent basalt gravel, cobbles, and stones; few fine black concretions; some bleached mineral grains; neutral (pH 6.8); gradual smooth boundary; 5 to 17 inches thick

C2r-39 inches; weathered basalt.

Depth to weathered bedrock is 20 to 40 inches. The solum is 19 to 23 inches thick

The A1 horizon has value of 6 or 7 dry and 3 to 5 moist and chroma of 2 or 3. It is stony loam or loam and is 5 to 15 percent rock fragments. The B horizon has value of 6 to 7 dry and 4 or 5 moist and chroma of 2 or 3. It is gravelly loam, cobbly loam, or stony loam and is 15 to 25 percent rock fragments. The C horizon has value of 6 or 7 dry and chroma of 3 or 4. It is 50 to 80 percent rock fragments.

Bobbitt series

The Bobbitt series consists of moderately deep, well drained soils that formed in residuum and colluvium derived from basalt with a thin mantle of loess and volcanic ash. These soils are on terrace escarpments and plains. They have slopes of 5 to 65 percent. The mean annual precipitation is about 25 inches, and mean annual air temperature is about 47 degrees F. Mean annual soil temperature is 47 to 52 degrees.

Bobbitt soils are similar to the Lacy, Schumacher, and Tekoa soils and are near the Blinn, Santa, and Taney soils. Lacy soils have basalt at a depth of 10 to 20 inches.

Schumacher soils average less than 35 percent rock fragments in the B horizon. Tekoa soils have weathered shale at a depth of 20 to 40 inches. Blinn soils have a light brownish gray and pale brown Al horizon and do not have a B2t horizon. Santa and Taney soils do not have coarse fragments.

Typical pedon of Bobbitt stony loam, along the north side of Plummer Creek in Heyburn State Park, 1,940 feet south and 320 feet east of the northwest corner of sec. 1, T. 46 N., R. 4 W.:

O11-2 inches to 1 inch; needles, twigs, and grass.

O12-1 inch to 0; partly decomposed needles, twigs, and moss.

Al-0 to 4 inches; brown (10YR 5/3) stony loam, very dark grayish brown (10YR 3/2) moist; weak thin and medium platy structure parting to weak fine and medium granular; soft, very friable, slightly sticky and nonplastic; many very fine and fine and common medium and coarse roots; common very fine interstitial pores; 25 percent gravel and stones; neutral (pH 6.8); diffuse smooth boundary; 4 to 12 inches thick.

B2t-4 to 21 inches; brown (10YR 5/3) very stony clay loam, dark brown (7.5YR 3/2) moist; weak fine and medium subangular blocky structure; hard, firm, slightly sticky and slightly plastic; common fine and medium and few coarse roots; common medium tubular pores; common thin clay films on faces of peds and in pores; about 50 percent stones and gravel; neutral (pH 7.0); clear irregular boundary; 16 to 28 inches thick.

Cr-21 inches; weathered basalt.

Depth to weathered basalt bedrock is 20 to 40 inches. The mollic epipedon ranges from 7 to 12 inches thick.

The A1 horizon has value of 4 or 5 dry and 2 or 3 moist. It is 10 to 30 percent rock fragments. The B2t horizon has hue of 10YR or 7.5YR, value of 5 to 7 dry and 3 or 4 moist, and chroma of 2 through 4. It is very stony loam or very stony clay loam and is 35 to 60 percent rock fragments.

Brickel series

The Brickel series consists of moderately deep, well drained soils that formed in residuum derived from granite with a mixture of loess and volcanic ash in the upper part. These soils are on mountains. They have slopes of 5 to 75 percent. The mean annual precipitation is about 40 inches, and mean annual air temperature is about 40 degrees F. Mean annual soil temperature is 39 to 46 degrees, and mean summer soil temperature is 50 to 59 degrees.

Brickel soils are similar to the McCrosket soils and are near the Ardenvoir, Divers, and Huckleberry soils. McCrosket soils have a mean annual soil temperature of more than 47 degrees. Ardenvoir soils have metasedimentary bedrock at a depth of 40 to 60 inches. Divers soils have more volcanic ash and a bulk density in the upper 30 inches of less than 0.95 grams per centimeter. Huckleberry soils have a bulk density to a depth of 14 inches or more of less than 0.85 grams per centimeter.

A typical pedon of Brickel cobbly loam, on an east-facing side slope, near Crystal Lake, about 3,360 feet north and 1,520 feet east of the southwest corner of see. 31, T. 47 N., R. 1 E.:

A1-0 to 3 inches; dark grayish brown (10YR 4/2) cobbly loam, very dark grayish brown (10YR 3/2) moist; weak very fine and fine granular structure; slightly hard, friable; nonsticky and nonplastic; many very fine, fine, and medium roots; many very fine tubular pores; 30 percent rock fragments; strongly acid (pH 52); clear wavy boundary; 3 to 10 inches thick.

B2-3 to 8 inches; dark brown (10YR 4/3) very cobbly loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; nonsticky and nonplastic; common very fine, fine, and medium roots; many very fine and few fine tubular pores; 55 percent rock fragments; strongly acid (pH 5.4); clear wavy boundary; 5 to 14 inches thick.

C1-8 to 16 inches; light yellowish brown (10YR 6/4) very cobbly loam, dark yellowish brown (10YR 4/4) moist; massive; soft, very friable; nonsticky and nonplastic; few very fine and fine roots; few fine tubular pores; 75 percent rock fragments; medium acid (pH 5.6); clear wavy boundary; 6 to 8 inches thick

C2-16 to 24 inches; light yellowish brown (10YR 6/4) very cobbly loam, dark yellowish brown (10YR 4/4) moist; massive; soft, very friable, nonsticky and nonplastic; few very fine and fine roots; 90 percent rock fragments; gradual irregular boundary; 6 to 8 inches thick.

C3r-24 inches; weathered granitic bedrock

Depth to weathered granitic bedrock is 20 to 40 inches. The solum is 8 to 24 inches thick.

The A horizon has value of 2 or 3 moist, chroma of 2 or 3 moist and dry, and hue of 10YR or 7.5YR. It is cobbly loam or cobbly silt loam and is 10 to 30 percent rock fragments. The B horizon has value of 4 or 5 dry and hue of 10YR or 7.5YR. It is very cobbly loam or very cobbly sandy loam and is 50 to 60 percent rock fragments. The C horizon ranges from very cobbly loam to very cobbly sandy loam and is 70 to 90 percent rock fragments.

Cald series

The Cald series consists of very deep, somewhat poorly drained soils that formed in alluvium derived from loess and volcanic ash. Cald soils are on bottom lands and in drainageways. They have slopes of 0 to 2 percent. These soils have a seasonal high water table at a depth of 3 to 5 feet from November to June. They are commonly flooded for brief periods from February to April. The mean annual precipitation is about 20 inches, and mean annual air temperature is about 47 degrees F. Mean annual temperature is 47 to 51 degrees.

Cald soils are similar to the Miesen and Palouse soils and are near the Latahco, Lovell, Naff, and Thatuna soils. Miesen soils are saturated by ground water from February to July. Palouse soils are well drained soils on loess hills. Lovell soils have a light gray A horizon. Latahco, Naff, and Thatuna soils have a silty clay loam B horizon.

Typical pedon of Cald silt loam, 0 to 2 percent slopes, about 6 miles northwest of Plummer, 680 feet south the northeast corner of NW1/4NW1/4 sec. 6, T. 46 N., R. 5 W.:

Ap1-0 to 3 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; moderate fine granular structure; soft, very friable, slightly sticky and slightly plastic; many fine roots; many very fine interstitial pores; medium acid (pH 6.0); abrupt smooth boundary; 2 to 4 inches thick.

Ap2-3 to 9 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak medium subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; many fine roots; many very fine and fine tubular pores; medium acid (pH 5.8); clear smooth boundary; 4 to 7 inches thick.

A13-9 to 18 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; moderate medium and fine subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; few fine roots; many very fine tubular pores; medium acid (pH 5.8); clear smooth boundary; 9 to 16 inches thick.

A14-18 to 25 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak medium subangular blocky structure: slightly hard, very friable, slightly sticky and slightly plastic; few fine roots; few very fine tubular pores; medium acid (pH 6.0); clear smooth boundary; 7 to 11 inches thick.

C1g-25 to 32 inches; gray (10YR 5/1) silt loam, very dark gray (10YR 3/1) moist; common fine distinct mottles; massive; slightly hard, very friable, slightly sticky and slightly plastic; few fine roots; many fine tubular pores; slightly acid (pH 6.2); clear smooth boundary; 6 to 12 inches thick.

C2-32 to 60 inches; very dark grayish brown (10YR 3/2) silt loam, very dark brown (10YR 2/2) moist; moderate fine angular blocky structure; slightly hard, friable, sticky and plastic; few fine roots; many very fine and fine tubular pores; few thin clay films on faces of peds and in pores; slightly acid (pH 6.4).

The mollic epipedon is 24 to 28 inches thick. The organic matter decreases irregularly as depth increases. The Ap or A1 horizon has value of 3 to 5 dry and 2 or 3 moist and chroma of 1 or 2. The C horizon is neutral and has hue of 10YR or 2.5YR, value of 3 to 6 dry and 2 to 4 moist, and chroma of 1 or 2. This horizon has few fine faint to many fine distinct mottles. In some pedons, a few fine basaltic pebbles make up less than 5 percent of the volume.

Chatcolet series

The Chatcolet series consists of very deep, moderately well drained soils that formed in a thin mantle of volcanic ash over glaciolacustrine material. These soils are on terraces. They have slopes of 3 to 20 percent. The mean annual precipitation is about 27 inches, and mean annual air temperature is about 40 degrees F. Mean annual soil temperature is 40 to 44 degrees. The mean summer soil temperature at a depth of 20 inches, in soil that has no 0 horizon, is 57 to 59 degrees. The solum is more than 60 inches thick.

Chatcolet soils are similar to the Benewah, Jacot, and Moctileme soils and are near the Bobbitt, Dorb, and Lacy soils. Benewah soils have a mean summer soil temperature of more than 59 degrees. Jacot soils have a coarse sandy loam and sandy loam B2t horizon. Moctileme soils are somewhat poorly drained and have a mean summer soil temperature of more than 55 degrees. Bobbitt, Dorb, and Lacy soils are more than 35 percent rock fragments in the B horizon.

Typical pedon of Chatcolet silt loam, 3 to 20 percent slopes, about 1.5 miles southeast of St. Maries, in the center of NE1/4 sec. 36, T. 46 N., R. 2 W.:

Ap-0 to 8 inches; brown (10YR 5/3) silt loam, dark brown (7.5YR 4/2) moist; weak medium platy structure parting to moderate fine and medium granular; soft, friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine and fine tubular pores; 5 percent gravel; neutral (pH 6.6); abrupt wavy boundary; 0 to 8 inches thick.

B21ir-8 to 16 inches; yellowish brown (10YR 5/4) silt loam, dark brown (7.5YR 4/4) moist; weak coarse prismatic structure; hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine, fine, and medium tubular pores; 5 percent gravel; neutral (pH 6.6); clear wavy boundary; 8 to 12 inches thick.

IIB22ir-16 to 24 inches; pale brown (10YR 6/3) silt loam, dark yellowish brown (10YR 4/4) moist; weak coarse prismatic structure parting to weak coarse subangular blocky; hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine, fine, and medium tubular pores; 5 percent gravel; slightly acid (pH 6.4); clear wavy boundary; 8 to 16 inches thick.

IIB23t-24 to 30 inches; pale brown (10YR 6/3) silt loam, dark yellowish brown (10YR 4/4) moist; weak medium prismatic structure parting to moderate medium subangular blocky; hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine, fine, and medium tubular pores; thin patchy clay films in clayey bands that occupy 50 percent of the horizon; many distinct black stains; 5 percent gravel; neutral (pH 6.8); clear wavy boundary; 6 to 8 inches thick.

IIB24t-30 to 60 inches; pale brown (10YR 6/3) silty clay loam, olive brown (2.5Y 4/4) moist; weak medium prismatic structure; very hard, firm, sticky and plastic; many very fine, fine, and medium tubular pores; moderately thick patchy clay films on clayey bands that occupy 25 percent of the horizon; many prominent black stains; 5 percent gravel; neutral (pH 7.0).

In undisturbed areas, a very thin layer, 1 to 2 centimeters thick, of recent volcanic ash is above the Bir horizon. The Ap horizon has hue of 10YR or 7.5YR, value of 5 to 7 dry and 4 or 5 moist, and chroma of 2 to 4. It is silt loam or loam. Structure is weak or moderate granular, subangular blocky, or platy. The B2ir horizon has hue of 10YR, 7.5YR, or 5YR, value of 5 to 7 dry and 3 to 5 moist, and chroma of 3 or 4. It is silt loam or loam. Structure is weak or moderate prismatic or subangular blocky. The IIB2t horizon has hue of 10YR or 2.5Y, value of 5 to 7 dry and 3 to 5 moist, and chroma of 3 or 4. It is silt loam, loam, silty clay loam, or clay loam, and some pedons are gravelly.

DeVoignes series

The DeVoignes series consists of very deep, very poorly drained soils that formed in stratified alluvium and organic materials. These soils are in basins and on flood plains. They have slopes of 0 to 2 percent. These soils are saturated with water during spring runoff, and unless drained, they have a seasonal high water table at a depth of less than 40 inches during spring and early in summer. In the summer when this soil dries, it forms cracks 1/2 inch to 2 inches wide to a depth of 3.5 feet. The mean annual precipitation is about 25 inches, and mean annual air temperature is about 44 degrees F. Mean annual soil temperature is 45 to 47 degrees.

DeVoignes soils are similar to the Ramsdell soils and are near the Miesen and Pywell soils. Ramsdell and Miesen are mineral soils and do not have organic soil horizons. Pywell soils are organic soils that do not have mineral soil horizons.

Typical pedon of DeVoignes silt loam, 2,996 feet east and 1,059 feet south of the northwest corner of sec. 21, T. 46 N., R. 2 W.:

Ap-0 to 9 inches; pale brown (10YR 6/3) silt loam, dark brown (10YR 4/3) moist; weak coarse subangular blocky parting to moderate very fine and fine granular; soft, very friable, nonsticky and nonplastic; common very fine roots; common very fine and many medium tubular pores; very strongly acid (pH 4.8); abrupt smooth boundary; 6 to 11 inches thick.

Oal-9 to 18 inches; grayish brown (10YR 5/2) on broken face, rubbed and pressed sapric material (about 75 percent organic matter) with very thin lenses of silt loam and silty clay loam, very dark grayish brown (10YR 3/2) moist; common fine prominent mottles of yellowish red (5YR 5/6): moderate coarse subangular blocky structure parting to moderate fine granular; slightly hard, firm, slightly sticky and nonplastic; roots tend to follow ped surfaces; common very fine and many medium tubular pores; very strongly acid (pH 4.5); abrupt smooth boundary; 6 to 13 inches thick.

Oa2-18 to 24 inches; gray (10YR 5/1) on broken face, rubbed and pressed sapric material (about 60 percent organic matter) with thin lenses of silt loam and silty clay loam, very dark gray (10YR 3/1) moist; common fine prominent mottles of yellowish red (5YR 5/6); moderate very coarse prismatic structure; very hard, very firm, sticky and slightly plastic; roots follow ped faces; common medium and very fine tubular pores; very strongly acid (pH 4.6); abrupt smooth boundary; 3 to 9 inches thick.

C-24 to 60 inches; light brownish gray (10YR 6/2) silty clay loam, grayish brown (10YR 5/2) moist; few fine prominent mottles of yellowish red (5YR 5/6); moderate coarse prismatic structure; very hard, very firm, sticky and plastic; roots tend to follow ped faces; common very fine and fine tubular pores; few cracks 1/4 to 3/4 inch wide; very strongly acid (pH 5.0).

The Ap horizon has value of 2 to 4 moist and 5 or 6 dry and chroma of 2 or 3. It is silt loam or mucky silt loam. The Oa horizon has value of 2 or 3 moist and 5 or 6 dry and chroma of 1 or 2. The C horizon has hue of 10YR to 5Y, value of 3 to 5 moist and 6 or 7 dry, and chroma of 1 or 2. This horizon has distinct or prominent mottles. It is mostly silty clay loam, but in some pedons, it is stratified with thin layers of silt loam or silty clay.

Divers series

The Divers series consists of very deep, well drained soils that formed in colluvium and residuum derived from metasedimentary rock with a mantle of volcanic ash. These soils are on mountains. They have slopes of 5 to 75 percent. The mean annual precipitation is about 42 inches, and mean annual air temperature is about 38 degrees F. Mean annual soil temperature is 35 to 40 degrees, and mean annual summer soil temperature is 44 to 46 degrees.

Divers soils are similar to the Dorb, Garveson, and Huckleberry soils and are near the Ardenvoir, Brickel, and McCrosket soils. Dorb soils have basalt at a depth of 20 to 40 inches. Garveson soils have a very gravelly coarse sand substratum above a depth of 40 inches. Huckleberry soils have weathered shale at a depth of 20 to 40 inches and bulk density to a depth of 14 inches or more of less than 0.85 grams per centimeter. Ardenvoir, Brickel; and McCrosket soils contain less volcanic ash and have a bulk density in the fine earth fraction of more than 0.95 grams per centimeter.

Typical pedon of Divers silt loam, 2,300 feet west and 20 feet south of the northeast corner of sec. 11, T. 44 N., R. 4 W.:

O11-2.5 to 1.5 inches; needles and twigs; slightly matted; slightly acid (pH 6.2); 0 to 1 inch thick.

O12-1.5 inches to 1.0 inch; partly decomposed needles and twigs; slightly matted; medium acid (pH 5.7); abrupt wavy boundary; 0 to 1/2 inch thick.

O1-1 inch to 0; well decomposed organic matter; slightly acid; abrupt wavy boundary; 0 to 1 inch thick.

A1-0 to 4 inches; dark brown (10YR 4/3) silt loam, dark brown (7.5YR 3/2) moist; strong very fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine and fine and common medium and coarse roots; many very fine interstitial and common fine tubular pores; 10 percent gravel; 5 percent cobbles; medium acid (pH 5.8); clear wavy boundary; 4 to 6 inches thick.

B21ir-4 to 9 inches; brown (7.5YR 5/4) silt loam, very (lark brown (7.5YR 3/2) moist; strong very fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine, fine, medium, and coarse roots; many very fine interstitial and common fine tubular pores; 10 percent gravel; 5 percent cobbles and stones; medium acid (pH 5.7); clear wavy boundary; 4 to 8 inches thick.

B22ir--9 to 12 inches; light yellowish brown (10YR 6/4) gravelly silt loam, (lark yellowish brown (10YR 4/4) moist; moderate very fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine, fine, medium, and coarse roots; common fine tubular pores; 20 percent gravel; 10 percent cobbles and stones; strongly acid (pH 5.4); abrupt wavy boundary; 3 to 5 inches thick.

IIB3ir-12 to 24 inches; brown (10YR 5/3) very stony silt loam, (lark brown (10YR 4/3) moist; weak medium subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; common very fine, fine, medium, and coarse roots; many fine and common medium tubular pores; 25 percent gravel; 35 percent cobbles and stones; strongly acid (pH 5.4); clear irregular boundary; 9 to 16 inches thick.

IIC1-24 to 40 inches; light yellowish brown (10YR 6/4) very stony loam, (lark brown (10YR 4/3) moist; massive; soft, very friable, nonsticky and nonplastic; few fine roots; many very fine and fine interstitial pores; 35 percent gravel; 35 percent cobbles and stones; very strongly acid (pH 5.0); clear wavy boundary; 16 to 20 inches thick.

IIIC2-40 to 60 inches; stones, cobbles, and gravel with some fines.

Depth to hard bedrock is 40 to more than 60 inches. The solum is 20 to 35 inches thick.

The Al horizon has hue of 10YR or 7.5YR, value of 4 or 5 dry and 3 or 4 moist, and chroma of 2 to 4. The Bir horizon has hue of 10YR to 5YR. It is 10 to 60 percent rock fragments but averages more than 35 percent. The C horizon is 65 to 95 percent metasedimentary rock fragments.

Dorb series

The Dorb series consists of moderately deep, well drained soils that formed in material weathered from basalt with a mantle of volcanic ash. These soils are on plateaus and escarpments and in mountain canyons. They have slopes of 5 to 65 percent. The mean annual precipitation is about 27 inches, and mean annual air temperature is about 40 degrees F. Mean annual soil temperature is 40 to 43 degrees, and mean summer soil temperature at a depth of 20 inches, in pedons that have an 0 horizon, is 44 to 47 degrees.

Dorb soils are similar to the Ardenvoir, Blinn, Divers, Garveson, Huckleberry, and Nakarna soils and are near the Bobbitt, Chatcolet, and Lacy soils. Ardenvoir and Blinn soils have a mean summer soil temperature of more than 47 degrees with an 0 horizon. Divers soils are more than 40 inches deep to bedrock. Garveson soils have a very gravelly coarse sand C horizon. Huckleberry soils have a very gravelly loam C horizon over weathered shale. Nakarna soils are less than 35 percent coarse fragments and are underlain by weathered schist at a depth of more than 40 inches. Bobbitt and Lacy soils have a mean annual soil temperature of more than 47 degrees. Chatcolet soils are less than 35 percent coarse fragments and are very deep.

Typical pedon of Dorb silt loam, about 3.5 miles southeast of St. Maries on Alternate U.S. Highway 96, about 50 feet south of the highway in the center of sec. 6, T. 45 N., R. 1 W.

O1-3 inches to 1 inch; needles, twigs, and moss.

O2-1 inch to 0; partly and well decomposed needles, twigs, and moss.

A2-0 to .5 inch; light gray (10YR 7/1) silt loam, weak fine gravelly structure; soft, very friable, nonsticky and nonplastic; many fine, very fine, and medium roots; volcanic ash; slightly acid (pH 6.4); abrupt smooth boundary; 0 to 1 inch thick.

B21ir-.5 inch to 3 inches; yellowish brown (10YR 514) silt loam, dark brown (7.5YR 3/2) moist; weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; many very fine, fine, and medium roots; 5 percent medium gravel; slightly acid (pH 6.4); clear wavy boundary; 0 to 4 inches thick.

B22ir-3 to 12 inches; yellowish brown (10YR 5/4) silt loam, dark brown (7.5YR 3/2) moist; weak medium subangular blocky structure parting to moderate very fine and fine granular; soft, very friable, slightly sticky and slightly plastic; many very fine, fine, and medium roots; 5 percent medium gravel; slightly acid (pH 6.4); clear wavy boundary; 7 to 16 inches thick.

IIB3ir-12 to 26 inches; yellowish brown (10YR 5/4) very cobbly silt loam dark brown (7.5YR 4/3) moist; massive; soft, very friable, slightly sticky and slightly plastic; many very fine, fine, and medium roots; 80 percent cobbles; neutral (pH 6.6); clear wavy boundary; 13 to 20 inches thick.

R-26 to 30 inches; fractured basalt.

Depth to bedrock ranges from 20 to 40 inches. Coarse fragments increase as depth increases and range in volume from 15 to 90 percent. In undisturbed areas, the pedons have a very thin layer of recent volcanic ash between the 0 and B2ir horizons. Where the 0 horizon is absent, a thin Al horizon is present. The Bir horizon has hue of 10YR or 7.5YR, value of 5 or 6 dry and 3 or 4 moist, and chroma of 3 or 4 dry and 2 to 4 moist. It is silt loam or loam.

Garfield series

The Garfield series consists of very deep, well drained soils that formed in loess with a mixture of volcanic ash. Garfield soils are on loess hills. They have slopes of 3 to 40 percent. The mean annual precipitation is about 20 inches, and mean annual air temperature is about 48 degrees F. Mean annual soil temperature is 48 to 52 degrees.

Garfield soils are near the Naff, Tilma, and Thatuna soils . Naff soils average less than 35 percent clay in the B horizon. Tilman and Thatuna soils have an A2 horizon.

Typical pedon of Garfield silty clay loam, in the SE1/4SE1/4 sec. 28, T. 45 N., R. 5 W.:

Ap-0 to 7 inches; brown (10YR 5/3) silty clay loam, dark brown (10YR 3/3) moist; strong medium and fine subangular blocky structure; hard, firm, very sticky and very plastic; plentiful fine roots; very fine interstitial and common very fine and fine tubular pores; medium acid (pH 5.7); abrupt smooth boundary; 5 to 8 inches thick.

B21t-7 to 10 inches; light brown (7.5YR 6/4) silty clay, dark brown (7.5YR 4/4) moist; strong medium and coarse prismatic structure; extremely hard, extremely firm, very sticky and very plastic; few fine roots; many very fine and fine tubular pores; thick continuous clay films on faces of peds; many black concretions; slightly acid (pH 6.5); clear smooth boundary; 3 to 7 inches thick.

B22t-10 to 18 inches; brown (Z5YR 5/4) silty clay, dark brown (7.5YR 4/4) moist; strong medium and coarse prismatic structure; extremely hard, extremely firm, very sticky and very plastic; few fine roots; common very fine and fine tubular pores; continuous moderately thick clay films on faces of peds and in pores; neutral (pH 6.7); gradual smooth boundary: 8 to 10 inches thick.

B23t-18 to 44 inches; light yellowish brown (10YR 614) silty clay loam, yellowish brown (10YR 5/4) moist; strong medium and fine angular and subangular blocky structure; very hard, firm, very sticky and very plastic; few fine roots; common very fine and fine tubular pores; common moderately thick clay films on faces of peds and in pores; mildly alkaline (pH 7.4); gradual smooth boundary; 10 to 26 inches thick.

B24t-44 to 59 inches; light yellowish brown (10YR 6/4) silty clay loam, (lark brown (10YR 4/3) moist; strong medium and fine angular blocky structure; hard, firm, very sticky and very plastic; few very fine tubular pores; common moderately thick clay films on faces of peels and in pores; neutral (pH 7.2); clear smooth boundary; 10 to 15 inches thick.

B3t-59 to 64 inches; light yellowish brown (10YR 6/4) silty clay loam, dark brown (10YR 4/3) moist; weak medium subangular blocky structure; hard, firm, very sticky and very plastic; few very fine pores; few thin clay films on faces of peels and in pores; neutral (pH 7.2).

The solum is more than 40 inches thick. The Ap horizon has value of 4 or 6 dry. It has subangular blocky or granular structure. The B2t horizon has value of 5 or 6 dry and 3 to 5 moist. It is silty clay or silty clay loam and is 36 to 45 percent clay. A few lime filaments are in the lower part of the B2t horizon in some pedons. The Bat has value of 5 or 6 dry and 4 or 5 moist. It is silty clay loam to silt loam.

Garveson series

The Garveson series consists of deep, well drained soils that formed in volcanic ash over well decomposed granitic bedrock. These soils are on mountains. They have slopes of 35 to 65 percent. The mean annual precipitation is about 35 inches, and mean annual air temperature is about 38 degrees F. Mean annual soil temperature is 38 to 42 degrees, and mean summer soil temperature at a depth of 20 inches in pedons that have an 0 horizon is 45 to 47 degrees.

Garveson soils are similar to the Divers, Dorb, Huckleberry, and Nakarna soils and are near the Jacot soils. Divers and Dorb soils average more than 35 percent rock fragments in the B horizon. Huckleberry soils have a very flaggy loam substratum over weathered shale bedrock. Nakarna soils are less than 35 percent coarse fragments above a depth of 40 inches. Jacot soils have a coarse sandy loam B horizon.

Typical pedon of Garveson loam, about 0.5 mile southeast Mueller's Camp in SW1/4NW1/4 sec. 27, T. 46 N., R. 1 W.:

O11-2 inches to .5 inch; undecomposed needles, leaves, and twigs.

O12-.5 inch to 0; partly decomposed needles, leaves, and twigs.

B21ir-0 to 5 inches; very pale brown (10YR 7/3) loam, dark brown (7.5YR 4/4) moist; moderate fine and medium granular structure; soft, very friable, slightly sticky and slightly plastic; many fine, medium, and coarse roots; common very fine interstitial pores; 5 percent gravel; medium acid (pH 6.8); clear wavy boundary; 5 to 8 inches thick.

B22ir-5 to 15 inches; very pale brown (10YR 7/3) loam, brown (7.5YR 4/4) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many fine, medium, and coarse roots; common very fine interstitial pores; 10 percent fine gravel; medium acid (pH 6.0); clear wavy boundary; 8 to 12 inches thick.

B23ir-15 to 21 inches ; very pale brown (10YR 7/3) gravelly silt loam, brown (7.5YR 5/4) moist; weak, medium, and coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine, medium, and coarse roots; common very fine interstitial pores; 20 percent fine gravel; medium acid (pH 5.8); abrupt wavy boundary: 5 to 8 inches thick.

IIC-21 to 60 inches; very gravelly coarse sand; 40 percent fine gravel.

A surface layer of recent ash as much as 1 inch thick is present in some undisturbed areas. The B2ir horizon has hue of 10YR or 7.5YR and value of 6 or 7 dry.

Helmer series

The Helmer series consists of very deep, moderately well drained soils that formed in thick loess deposits. The upper layer of loess is high in volcanic ash. These soils are on loess hills. They have slopes of 3 to 40 percent. The mean annual precipitation is about 35 inches, and mean annual air temperature is about 42 degrees F. Mean annual soil temperature is 42 to 46 degrees, and mean summer soil temperature at a depth of 20 inches, in pedons that have an O horizon, is 45 to 47 degrees.

Helmer soils are similar to the Nakarna and Santa soils and are near the Huckleberry, Porrett, and Taney soils. Nakarna soils do not have a fragipan and are on mountains underlain by schist. Santa soils average less than 18 percent clay in the B2 horizon and have less volcanic ash than Helmer soils. Huckleberry soils do not have a fragipan and are on uplands underlain by weathered shale. Porrett soils do not have a fragipan and are very poorly drained. Taney soils do not have a fragipan and have less volcanic ash.

Typical pedon of Helmer silt loam, 3 to 20 percent slopes, north of Alder Creek Flats, 100 feet west of road in SW1/4NE1/4 sec. 24, T. 45 N., R. 3 W.:

O11-2.5 to 2 inches; slightly decayed needles, leaves, and twigs; slightly matted; medium acid (pH 5.6); abrupt wavy boundary.

O12-2 inches to 0.5 inch; very dark grayish brown (10YR 3/2) moderately decayed needles and twigs, very dark brown (10YR 2/2) moist; matted; few spots of fungi; many very fine and fine roots; slightly acid (pH 6.2); abrupt wavy boundary.

O2-0.5 inch to 0; very dark gray (10YR 3/1) well decayed organic material; black (10YR 2/1) moist; strong very fine granular structure; soft, very friable; many very fine and fine roots; many fine interstitial pores; pockets of ash beneath layer; slightly acid (pH 6.1); abrupt wavy boundary.

B21ir-0 to 7 inches; light yellowish brown (10YR 6/4) silt loam, dark brown (7.5YR 4/4) moist; strong very fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine to coarse roots; many very fine interstitial pores; few 1- to 2-millimeter semihard concretions; slightly acid (pH 6.1); gradual wavy boundary; 4 to 10 inches thick.

B22ir-7 to 13 inches; light yellowish brown (10YR 6/4) silt loam, dark brown (7.5YR 4/4) moist; moderate very fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine to coarse roots; many very fine interstitial pores; few 1- to 3-millimeter semihard concretions; medium acid (pH 5.9); gradual wavy boundary; 7 to 15 inches thick.

B23ir-13 to 19 inches; light yellowish brown (10YR 6/4) silt loam, dark yellowish brown (10YR 4/4) moist; weak very fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine to coarse roots; many very fine interstitial pores; few 1- to 3-millimeter semihard concretions; strongly acid (pH 5.5); abrupt wavy boundary; 4 to 8 inches thick.

IIA&B'x-19 to 32 inches; pale brown (10YR 6/3) silt loam, dark brown (10YR 4/3) moist; weak very coarse prismatic structure parting to weak medium and coarse subangular blocky; very hard, firm and brittle, slightly sticky and slightly plastic; roots are concentrated in vertical cracks, some are flattened, none within peds; common fine tubular pores; few 1- to 2-milimeter semihard concretions; very strongly acid (pH 4.6); diffuse wavy boundary; 7 to 16 inches thick.

IIB&A'x-32 to 42 inches; light yellowish brown (10YR 6/4) silt loam, dark yellowish brown (10YR 4/4) moist; weak very coarse prismatic structure parting to weak coarse subangular blocky; very hard, firm and brittle, slightly sticky and slightly plastic; roots are concentrated along ped faces, some are flattened, none within peels; common fine tubular pores; thin patchy clay films on faces of peds with light gray speckings; many reddish brown and black semihard concretions less than 1 millimeter thick; few 1- to 2-millimeter hard concretions; 70 percent material from the B horizon; material from the A2 horizon in spots, in channels of roots, and on faces of prisms and blocks; very strongly acid (pH 4.7); abrupt wavy boundary; 8 to 18 inches thick.

IIB'tx-42 to 60 inches; light yellowish brown (10YR 6/4) silt loam, dark brown (7.5YR 4/4) moist; weak very coarse prismatic structure; very hard, firm and brittle, sticky and plastic; many very fine tubular pores; thick continuous clay films on vertical ped faces; common black and reddish brown concretions less than 1 millimeter thick; very few pebbles; extremely acid (pH 4.3).

The solum is 36 to more than 60 inches thick. Depth to the top of the fragipan is 15 to 33 inches. An argillic horizon is below the fragipan. In some pedons, a very thin or faint ash layer is between the 0 horizon and upper part of the B horizon.

The O horizon is absent, and a thin A1 horizon is present in some pedons where the surface has been disturbed or opened to grasses. The Bir horizon has hue of 10YR or 7.5YR and value of 5 to 6 dry. The layer from a depth of 10 inches to the fragipan is silt loam or silt. The fragipan is silt loam or silt. The B2tb horizon is silt loam or silty clay loam.

Huckleberry series

The Huckleberry series consists of moderately deep, well drained soils that formed in a mantle of loess and volcanic ash over material weathered from sedimentary rock. These soils are on mountains. They have slopes of 5 to 65 percent. The mean annual precipitation is about 35 inches, and mean annual air temperature is about 41 degrees F. Mean annual soil temperature is 38 to 44 degrees, and mean summer soil temperature, in pedons that have an O horizon, is 44 to 45 degrees.

Huckleberry soils are similar to the Divers and Dorb soils and are near the Ardenvoir, McCrosket, and Santa soils. Divers soils have bedrock at a depth of 48 to more than 60 inches. Dorb soils have fractured basalt at a depth of 20 to 40 inches. Ardenvoir soils have less volcanic ash and a bulk density in the fine earth fraction of more than 0.85 grams per centimeter. McCrosket soils have a mollic epipedon and a mean annual soil temperature of more than 47 degrees. Santa soils do not have coarse fragments and have a fragipan.

Typical pedon of Huckleberry silt loam, on Skyline Drive, 0.4 mile from U.S. Highway 95, 100 feet below road, 2,000 feet west and 1,100 feet south of the northeast corner of sec. 20, T. 43 N., R. 4 W.:

O11-2.5 to 2 inches; relatively fresh coniferous needles and twigs; slightly acid (pH 6.2).

O12-2 inches to 0; partly decomposed coniferous needles and twigs; neutral (pH 6.6).

B21ir-0 to 4 inches; yellowish brown (10YR 5/4) silt loam, dark brown (7.5YR 4/4) moist; weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; many fine and medium roots; many fine and few medium tubular pores; medium acid (pH 6.0); clear smooth boundary; 4 to 6 inches thick.

B22ir-4 to 16 inches; light yellowish brown (10YR 614) silt loam, dark brown (7.5YR 4/4) moist; weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; many fine and medium roots; many fine and few medium tubular pores; medium acid (pH 6.0); abrupt smooth boundary; 6 to 12 inches thick.

IIB23ir-16 to 26 inches; pale brown (10YR 6/3) gravelly silt loam, dark yellowish brown (10YR 3/4) moist; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few fine and medium roots; common fine and few medium tubular pores; thin patchy clay films on faces of peds; 20 percent angular gravel; medium acid (pH (3.0); abrupt smooth boundary; 6 to 10 inches thick.

IIC1-26 to 36 inches; very pale brown (10YR 7/3) very gravelly loam, yellowish brown (10YR 5/4) moist; massive; slightly hard, friable, slightly sticky and slightly plastic: few fine roots; 60 percent coarse fragments; medium acid (pH 5.8); abrupt wavy boundary; 4 to 12 inches thick.

IICr2-36 inches; weathered shale.

Depth to weathered shale bedrock is 20 to 40 inches. The solum is 16 to 28 inches thick.

Some pedons have a thin layer of recent volcanic ash above the Bir horizon. The Bir horizon has hue of 10YR to 5YR. It is 0 to 25 percent coarse fragments. The IIC horizon has hue of 10YR or 7.5YR, value of 6 or 7 dry and 4 or 5 moist, and chroma of 3 or 4. It is very gravelly silt loam or very gravelly loam and is 50 to 90 percent rock fragments.

Jacot series

The Jacot series consists of very deep, well drained soils that formed in a mantle of volcanic ash and loess over material weathered from granitic bedrock. These soils are on mountains. They have slopes of 35 to 65 percent. The mean annual precipitation is about 35 inches, and mean annual air temperature is about 38 degrees F. Mean annual soil temperature is 38 to 42 degrees, and mean summer soil temperature, in pedons that have an 0 horizon, is 45 to 47 degrees.

Jacot soils are similar to the Chatcolet soils and are near the Dorb, Garveson, and Helmer soils. Chatcolet soils have a silt loam and silty clay loam B horizon. Dorb soils have a very cobbly silt loam B horizon. Garveson soils have a very gravelly coarse sand C horizon. Helmer soils have a fragipan.

Typical pedon of Jacot coarse sandy loam, about 0.4 mile southwest of Muellers Camp, 500 feet south of the northeast corner of NW1/4 sec. 28, T. 46 N., R. 1 W.:

O11-2.5 inches to .5 inch; undecomposed needles, twigs, and leaves.

O12-.5 inch to 0; partly decomposed needles, twigs, and leaves.

A2-0 to .25 inch; pale brown (10YR 6/3) silt loam, dark brown (10YR 4/3) moist; weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; many very fine, fine, and medium roots; slightly acid (pH 6.2); abrupt broken boundary; 0 to 1 inch thick.

B21ir-.25 inch to 3 inches; brown (10YR 5/3) coarse sandy loam, dark brown (10YR 3/3) moist; moderate very fine and fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine, fine, and medium roots; many very fine interstitial pores; 5 percent fine gravel; slightly acid (pH 62); clear wavy boundary; 1 to 4 inches thick.

B22ir-3 to 12 inches; light yellowish brown (10YR 6/4) coarse sandy loam, dark yellowish brown (10YR 4/4) moist; weak medium granular structure; soft, very friable, slightly sticky and slightly plastic; many very fine, fine, and medium roots; many very fine interstitial pores; 5 percent fine gravel; slightly acid (pH 6.2); clear wavy boundary; 10 to 14 inches thick.

B23ir-12 to 20 inches; light yellowish brown (10YR 6/4) coarse sandy loam, dark yellowish brown (10YR 4/4) moist; weak medium granular structure; soft, very friable, slightly sticky and slightly plastic; common very fine, fine, and medium roots; many very fine interstitial pores; 5 percent fine gravel; slightly acid (pH 6.2); abrupt wavy boundary; 7 to 10 inches thick.

IIB'24t-20 to 31 inches; light yellowish brown (10YR 6.4) coarse sandy loam, dark yellowish brown (10YR 4/4) moist; moderate coarse subangular blocky structure; hard, firm, slightly sticky and slightly plastic; common very fine and fine roots; many fine and medium tubular pores; many thin clay films on faces of peels; 10 percent fine gravel; medium acid (pH 5.8); gradual wavy boundary; 10 to 15 inches thick.

IIB'25t-31 to 43 inches; very pale brown (10YR 7/4) coarse sandy loam, yellowish brown (10YR 5/4) moist; weak coarse subangular blocky structure; hard, firm, slightly sticky and slightly plastic; common very fine and fine roots; many fine and medium tubular pores; thin continuous clay films on faces of peds; 10 percent fine gravel; medium acid (pH 5.6); clear wavy boundary; 8 to 12 inches thick.

IIC-43 to 60 inches; pale yellow (2.5Y 7/4) very gravelly sandy loam, light olive brown (2.5Y. 5/4) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; 40 percent fine gravel; few very fine and fine roots; many very fine interstitial pores; medium acid (pH 5.6).

The B2ir horizon has hue of 10YR or 7.5YR, value of 5 or 6 dry and 3 to 5 moist, and chroma of 2 to 4. The IIB'2t horizon has hue of 10YR, 7.5YR, or 2.5Y; value of 6 to 8 dry and 4 or 5 moist; and chroma of 3 or 4.

Lacy series

The Lacy series consists of shallow, well drained soils that formed in material derived from basalt and a minor amount of loess in the upper part. These soils are on terrace breaks and mountains. They have slopes of 5 to 65 percent. The mean annual precipitation is about 25 inches, and mean annual air temperature is about 48 degrees F. Mean annual soil temperature is 47 to 52 degrees.

Lacy soils are similar to the Bobbitt and Tekoa soils and are near the Blinn, Santa, and Taney soils. Blinn, Bobbitt, and Tekoa soils have bedrock at a depth of 20 to 40 inches. Santa soils formed in deep loess and have a fragipan. Taney soils are very deep and do not have coarse fragments.

Typical pedon of Lacy stony loam, in Heyburn State Park, 2,200 feet east and 2,000 feet north of the southwest corner of sec. 12, T. 46 N., R. 4 W.:

O1-1 inch to 0; undecomposed pine needles and grass.

A1-0 to 4 inches; brown (10YR 4/3) stony loam, dark reddish brown (5YR 2/2) moist; weak fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; common very fine and fine irregular pores; 10 percent gravel and stones; neutral (pH 6.8); clear wavy boundary; 3 to 4 inches thick

B1t-4 to 9 inches; dark brown (7.5YR 4/4) stony clay loam, dark reddish brown (5YR 2/2) moist; weak medium subangular blocky structure; hard, firm, sticky and plastic; common very fine and fine roots; common very fine tubular pores; 30 percent gravel stones; slightly acid (p11 6.4); clear wavy boundary; 4 to 8 inches thick.

B2t-9 to 14 inches; dark brown (7.5YR 4/4) very stony clay loam, dark reddish brown (5YR 3/3) moist; weak medium and coarse subangular blocky structure; very hard, firm, sticky and plastic; common very fine and fine roots; common very fine and fine tubular pores; 60 percent gravel and stones; thin continuous clay films on peds and in pores; medium acid (pH 6.0); clear wavy boundary; 3 to 8 inches thick.

R-14 inches; fractured basalt.

Depth to fractured basalt bedrock is 10 to 20 inches.

The A1 horizon has hue of 10YR to 5YR, value of 4 or 5 dry and 2 or 3 moist, and chroma of 2 to 4. It is 5 to 25 percent rock fragments. The Bt horizon has hue of 5YR to 10YR, value of 4 or 5 dry and 3 or 4 moist, and chroma of 2 to 4. It is stony clay loam, stony loam, and very stony clay loam. This horizon is 25 to 80 percent rock fragments, but a weighted average is more than 35 percent.

Larkin series

The Larkin series consists of very deep, well drained soils that formed in loess and in places, some volcanic ash. These soils are on loess hills. They have slopes of 3 to 20 percent. The mean annual precipitation is about 23 inches, and mean annual air temperature is about 47 degrees F. Mean annual soil temperature is 47 to 52 degrees.

Larkin soils are similar to the Naff and Schumacher soils and are near the Pedee, Southwick, and Tensed soils. Naff soils have a dark grayish brown and brown A horizon that is 14 to 20 inches thick. Schumacher soils contain coarse fragments and have weathered sedimentary rock at a depth of 20 to 40 inches. Pedee, Southwick, and Tensed soils have an A'2 horizon and are moderately well drained.

Typical pedon of Larkin silt loam, 50 feet east of a road, about 1,300 feet south and 2,500 feet west of the northeast corner of sec. 12, T. 44 N., R. 5 W.:

Ap-0 to 11 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak medium subangular blocky structure parting to moderate medium granular; soft, very friable, slightly sticky and slightly plastic; many very fine, fine, and medium roots; many very fine and fine tubular pores; slightly acid (pH 6.5); abrupt wavy boundary; 4 to 11 inches thick.

A12-11 to 18 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak coarse subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; many very fine, fine, and medium roots; many very fine and fine tubular pores; slightly acid (pH 6.5); gradual wavy boundary; 5 to 7 inches thick.

A13-18 to 27 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; moderate medium prismatic structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and medium roots; common very fine and fine tubular pores; slightly acid (pH 6.5); clear wavy boundary; 8 to 10 inches thick.

B1-27 to 30 inches; brown (10YR 5/3) silt loam, dark brown (10YR 3/3) moist; moderate medium prismatic structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and few fine roots; common very fine and few fine tubular pores; thin silt coatings on faces of peds; medium acid (pH 6.0); abrupt wavy boundary; 3 to 6 inches thick

B21t-30 to 45 inches; brown (7.5YR 5/4) silt loam, dark brown (7.5YR 4/4) moist; weak coarse prismatic structure parting to moderate fine angular blocky; very hard, very firm, sticky and slightly plastic; few fine and medium roots; few very fine tubular pores; thin silt coatings on faces of peds; common moderately thick clay films on faces of peds and in pores; medium acid (pH 5.8); gradual wavy boundary; 10 to 15 inches thick.

B22t-45 to 55 inches; light yellowish brown (10YR 6/4) silty clay loam, dark yellowish brown (10YR 4/4) moist; weak coarse prismatic structure parting to moderate fine angular blocky; hard, firm, sticky and plastic; few fine roots; few very fine and fine tubular pores; common moderately thick clay films on faces of peds and in pores; mildly alkaline (pH 7.5); gradual wavy boundary; 8 to 12 inches thick.

B3-55 to 60 inches; light yellowish brown (10YR 6/4) silt loam, dark yellowish brown (10YR 4/4) moist; weak coarse prismatic structure parting to weak medium angular blocky; hard, friable, slightly sticky and slightly plastic; no roots observed; few very fine and fine tubular pores; few black concretions; mildly alkaline (pH 7.5).

The solum is 42 to more than 60 inches thick.

The A horizon has value of 2 or 3 moist. The B2t horizon has chroma of 3 or 4 moist and dry.

Latahco series

The Latahco series consists of very deep, somewhat poorly drained soils that formed in alluvium derived from surrounding loess hills. These soils are on low terraces and bottom lands and in drainageways. They have slopes of 0 to 2 percent. These soils have a seasonal high water table at a depth of 6 to 30 inches from March to May and are occasionally flooded for brief periods from February to April. The mean annual precipitation is about 20 inches, and mean annual air temperature is about 43 degrees F. The mean annual soil temperature is 43 to 47 degrees, and the mean summer soil temperature is 59 to 63 degrees.

Latahco soils are similar to the Southwick, Tensed, Thatuna, and Tilma soils and are near the Cald, Lovell, and Moctileme soils. Southwick, Tensed, Thatuna, and Tilma soils are moderately well drained and have a mean annual soil temperature of more than 47 degrees. Cald soils do not have an A2 horizon or a B2t horizon. Lovell and Moctileme soils have a light brownish gray A horizon.

Typical pedon of Latahco silt loam, 0 to 2 percent slopes, about 4 miles north of Tensed, 300 feet west of U.S. Highway 95 at Benewah Creek Road intersection, 920 feet west and 60 feet south of the northeast corner of NE1/4SE1/4 see. 27, T. 45 N., R. 5 W.:

Ap-0 to 8 inches; dark gray (10YR 4/1) silt loam, black (10YR 2/1) moist; weak thin and medium platy structure parting to weak fine granular; slightly hard, friable, slightly sticky and slightly plastic; common fine and very fine roots; many very fine interstitial pores; few bleached silt grains; slightly acid (pH 6.5); abrupt smooth boundary; 6 to 10 inches thick

A12-8 to 13 inches; dark gray (10YR 4/1) silt loam, black (10YR 2/1) moist; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and very fine roots; many fine and very fine tubular pores; few bleached silt grains; neutral (pH 6.6); clear irregular boundary; 4 to 12 inches thick.

A13-13 to 17 inches; gray (10YR 5/1) silt loam, black (10YR 2/1) moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few fine and very fine roots; many very fine tubular pores; many bleached silt grains; few fine black concretions; neutral (pH 6.8); clear wavy boundary; 1 to 5 inches thick.

A2-17 to 21 inches; light gray (10YR 6/1) silt loam high in coarse silt, very dark gray (10YR 3/1) moist; very few fine brownish mottles; massive; soft, very friable, slightly sticky and nonplastic; few fine roots; many fine and very fine tubular pores; common soft fine black concretions; neutral (pH 7.0); abrupt wavy boundary; 2 to 8 inches thick.

B21t-21 to 26 inches; grayish brown (2.5Y 5/2) silty clay loam, dark gray (2.5Y 4/1) moist; moderate medium prismatic structure parting to moderate medium angular blocky; very hard, firm, sticky and plastic; few fine roots; many very fine and fine tubular pores; continuous moderately thick very dark gray (10YR 3/1) clay films on faces of peds; many soft fine black concretions; mildly alkaline (pH 7.4); clear smooth boundary; 5 to 7 inches thick.

B22tca-26 to 32 inches; grayish brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist: moderate medium prismatic structure parting to moderate medium angular blocky; very hard, firm, sticky and plastic; few fine exped roots; many fine and very fine tubular pores; continuous moderately thick very dark grayish brown (10YR 3/2) clay films on faces of peds; many fine soft black concretions, noncalcareous matrix that has thin seams and old root channels coated with white (10YR 8/1) lime; moderately alkaline (pH 7.9); clear smooth boundary; 5 to 8 inches thick.

B31tca-32 to 42 inches; grayish brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; moderate medium and coarse prismatic structure parting to moderate coarse angular blocky; very hard, firm, sticky and plastic; common fine and medium tubular pores; continuous moderately thick clay films on faces of peds and continuous thick clay films in pores; few fine black concretions; noncalcareous matrix that has thin white (10YR 8/1) seams and splotches of lime; moderately alkaline (pH 82); clear smooth boundary; 5 to 11 inches thick.

B32t-42 to 51 inches; light brownish gray (2.5Y 6/2) silt loam, grayish brown (2.5Y 5/2) moist; few fine distinct yellowish brown (10YR 5/6) mottles; weak very coarse prismatic structure; very hard, firm, sticky and plastic; few fine and medium tubular pores; continuous thin clay films on faces of peds and continuous thick clay films in pores; mildly alkaline (pH 7.8); abrupt wavy boundary; 8 to 14 inches thick

C-51 to 60 inches; light gray (2.5Y 7/2) silt loam, grayish brown (10YR 5/2) moist; many fine and medium distinct yellowish brown (10YR 5/6 and 5/4) mottles; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine and medium pores; continuous moderately thick clay films in pores; many fine and medium black concretions; moderately alkaline (pH 8.0).

The solum is 40 to 55 inches thick. Depth to the B2t horizon is 18 to 30 inches, and depth to calcareous material is 25 to 55 inches or more.

The Ap or A1 horizon has value of 3 to 5 dry and 1 to 3 moist. The A2 horizon has value of 5 to 7 dry and 2 or 3 moist. The interior of the peds in the B2t horizon has value of 4 or 5 dry and 3 or 4 moist, chroma of 1 or 2, and dominant hue of 2.5Y but ranges to 10YR. The B2t horizon is silty clay loam or silt loam.

Lovell series

The Lovell series consists of very deep, somewhat poorly drained soils that formed in alluvium derived from loess, basalt, metasedimentary rock, and volcanic ash. These soils are on bottom lands and have slopes of 0 to 2 percent. These soils have a seasonal high water table at a depth of 18 to 24 inches from February to May. They are frequently flooded for brief periods from February to April. The mean annual precipitation is about 20 inches, and mean annual air temperature is about 44 degrees F. Mean annual soil temperature is 45 to 47 degrees.

Lovell soils are similar to the Benewah and Moctileme soils and are near the Cald and Latahco soils. Benewah soils are moderately well drained and on mountain foot slopes. Moctileme soils have a high volcanic ash content. Cald soils have a mollic epipedon and a mean annual soil temperature of more than 47 degrees. Latahco soils have a dark gray A horizon.

Typical pedon of Lovell silt loam, about 1.5 miles northwest of Tensed, about 600 feet north and 45 feet east of the center of SW1/4NE1/4 sec. 10, T. 44 N., R. 5 W.:

Ap-0 to 8 inches; light brownish gray (10YR 6/2) silt loam, very dark gray (10YR 2/2) moist; weak medium granular structure; slightly hard, very friable, slightly sticky and slightly plastic; common very fine roots; many fine interstitial pores; medium acid (pH 6.0); abrupt smooth boundary; 6 to 10 inches thick.

A21-8 to 14 inches; gray (10YR 6/1) silt loam, very dark brown (10YR 2/2) moist; weak medium platy structure parting to weak fine subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots; many fine tubular pores; common fine black concretions; slightly acid (pH 6.4); clear smooth boundary; 4 to 8 inches thick.

A22-14 to 18 inches; gray (10YR 6/1) silt loam, very dark gray (10YR 3/1) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; few very fine roots; many fine tubular pores; common fine black concretions; slightly acid (pH 6.5); abrupt smooth boundary; 2 to 6 inches thick.

B21t-18 to 22 inches; gray (10YR 6/1) silt loam, very dark grayish brown (10YR 3/2) moist; strong medium and thin platy structure; hard, friable, slightly sticky and slightly plastic; few very fine roots; many fine tubular pores; common fine black concretions; thick nearly continuous very dark brown (10YR 2/2) moist, clay films on horizontal faces of peds; neutral (pH 6.7); abrupt smooth boundary; 2 to 6 inches thick

B22t-22 to 26 inches; light gray (10YR 7/2) silt loam, dark grayish brown (10YR 4/2) moist; weak fine and medium subangular blocky structure; hard, firm, slightly sticky and slightly plastic; many fine and very fine interstitial pores; medium continuous very dark brown (10YR 2/2) moist; clay films in pores; neutral (pH 7.0); abrupt smooth boundary; 2 to 6 inches thick

B23t-26 to 34 inches; light gray (10YR 7/2) silt loam, dark grayish brown (10YR 4/2) moist; weak thin and medium platy structure; hard, firm, slightly sticky and slightly plastic; many very fine tubular pores; thick nearly continuous very dark brown (10YR 2/2) moist; clay films on faces of peds and in pores; neutral (pH 7.0); clear smooth boundary; 6 to 9 inches thick.

IIB24t-34 to 37 inches; light gray (10YR 7/2) loam, dark grayish brown (10YR 4/2) moist; weak thin platy structure; hard, firm, slightly sticky and slightly plastic; common very fine tubular pores; thick continuous very dark grayish brown (10YR 3/2) moist; clay films on faces of peds and in pores; neutral (pH 7.0); clear smooth boundary, - 2 to 6 inches thick

IIB25t-37 to 44 inches; light yellowish brown (10YR 6/4) loam, dark yellowish brown (10YR 4/4) moist; weak thin platy structure; slightly hard, firm, slightly sticky and slightly plastic; common very fine tubular pores; medium nearly continuous very dark (10YR 3/1) moist, clay films on faces of peds and in pores; neutral (pH 6.7); clear smooth boundary; 4 to 10 inches thick.

IIB3t 44 to 51 inches; very pale brown (10YR 7/3) loam, dark brown (10YR 4/3) moist; common medium and coarse distinct reddish brown (10YR 5/4) mottles; weak thin platy structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine tubular pores; medium nearly continuous clay films in pores; neutral (pH 6.8); abrupt smooth boundary; 4 to 10 inches thick

IIC-51 to 60 inches; light gray (10YR 7/2) loam, pale brown (10YR 6/3) moist; many coarse prominent reddish brown (10YR 5/4) and yellowish red (5YR 5/6) mottles; massive; slightly hard, friable, slightly sticky and slightly plastic; common very fine tubular pores; common fine black concretions; neutral (pH 6.9).

The solum is 40 to 60 inches thick.

The Ap or A1 horizon has value of 5 or 6 dry and 2 to 4 moist and chroma of 2 to 4 dry and 1 to 3 moist. The Bt horizon has value of 3 or 4 moist. It is silt loam, silty clay loam, or loam.

McCrosket series

The McCrosket series consists of deep, well drained soils that formed in materials weathered from metasedimentary rock with a mantle of loess. These soils are on mountains. They have slopes of 5 to 65 percent. The mean annual precipitation is about 25 inches, and mean annual air temperature is about 47 degrees F. Mean annual soil temperature is 47 to 51 degrees.

McCrosket soils are similar to the Bobbitt, Schumacher, and Tekoa soils and are near the Ardenvoir, Huckleberry, and Pedee soils. Bobbitt soils have a very stony clay loam B horizon. Schumacher soils average less than 35 percent rock fragments in the B horizon. Tekoa soils have bedrock at a depth of 20 to 40 inches. Ardenvoir and Huckleberry soils have a mean annual soil temperature of less than 47 degrees. Pedee soils have a very gravelly clay B2t horizon.

Typical pedon of McCrosket gravelly silt loam, very steep, about 2 miles northeast of Moses Mountain, near the southeast corner of NE1/4NW1/4 sec. 11, T. 44 N., R. 4 E.:

O1-2 inches to 0; partly decomposed duff and needles.

All-0 to 5 inches; dark grayish brown (10YR 4/2) gravelly silt loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; soft, very friable, slightly sticky and slightly plastic; many very fine interstitial and tubular pores; 30 percent gravel; neutral (pH 6.8); abrupt smooth boundary; 5 to 7 inches thick.

A12-5 to 11 inches; brown (10YR 5/3) gravelly silt loam, dark brown (10YR 3/3) moist; moderate medium granular structure; soft, very friable; slightly sticky and slightly plastic; common very fine and fine roots; common very fine and fine tubular and interstitial pores; 30 percent gravel; neutral (pH 6.8); clear *wavy* boundary; 6 to 10 inches thick.

B1-11 to 18 inches; light yellowish brown (10YR 6/4) very gravelly silt loam, dark yellowish brown (10YR 4/4) moist; weak fine subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; common fine and few medium roots; common very fine and fine and few medium tubular and interstitial pores; 60 percent gravel; medium acid (pH 6.0); gradual wavy boundary; 7 to 11 inches thick.

B2-18 to 29 inches; light yellowish brown (10YR 6/4) very gravelly silt loam, dark yellowish brown (10YR 4/4) moist; weak medium subangular blocky structure parting to weak fine granular; slightly hard, very friable, slightly sticky and slightly plastic; few fine, medium, and coarse roots; few very fine, fine, and medium interstitial and tubular pores; 70 percent gravel and stones; medium acid (pH 6.0); clear wavy boundary; 10 to 12 inches thick.

B3-29 to 42 inches; very pale brown (10YR 7/4) very stony silt loam, yellowish brown (10YR 5/6) moist; weak medium and fine subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; few very fine and medium roots; many very fine tubular and interstitial pores; 70 percent gravel and stones; medium acid (pH 6.0); clear wavy boundary; 12 to 25 inches thick.

Cr-42 inches; weathered metasedimentary bedrock.

The mollic epipedon is 11 to 17 inches thick, and the solum is 40 to 60 inches thick. Depth to weathered bedrock is 40 to 60 inches, and consolidated bedrock is deeper than 5 feet.

The A horizon has value of 3 to 5 dry and 2 or 3 moist and chroma of 2 or 3. The B horizon has value of 5 to 7 dry and 3 to 5 moist and chroma of 3 to 6. It is very gravelly or very stony silt loam or loam. This horizon averages 50 to 80 percent rock fragments.

Miesen series

The Miesen series consists of very deep, somewhat poorly drained soils that formed in mixed alluvium. These soils are on low terraces and flood plains. They have slopes of 0 to 2 percent. These soils are saturated during the spring. The seasonal high water table ranges from the surface to a depth of 48 inches from February to July. The soils are frequently flooded for very long periods from February to April. The mean annual precipitation is about 28 inches, and mean annual air temperature is about 44 degrees F. Mean annual soil temperature is 45 to 47 degrees.

Miesen soils are similar to the Cald and Pokey soils and are near the DeVoignes, Pywell, and Ramsdell soils. Cald soils have a mean annual soil temperature of more than 47 degrees. Pokey soils are very poorly drained and have a coarse sand and gravel IIC horizon. DeVoignes soils contain organic layers. Pywell soils are organic. Ramsdell soils are very poorly drained and have a light gray A horizon.

Typical pedon of Miesen silt loam, about 600 feet south of the St. Joe River, 560 feet west and 100 feet south of the northeast corner of sec. 23, T. 46 N., R. 1 W.:

Ap-0 to 4 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; moderate fine and medium granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine, fine, and medium roots; many very fine and fine interstitial pores; slightly acid (pH 6.2); gradual wavy boundary; 0 to 4 inches thick.

A12-4 to 11 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak fine and medium subangular blocky structure parting to weak fine granular; slightly hard, friable, slightly sticky and slightly plastic; many very fine and few fine and medium roots; few very fine and fine tubular pores; slightly acid (pH 6.2); gradual wavy boundary; 7 to 10 inches thick.

A13-11 to 20 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak medium and coarse prismatic structure parting to weak medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; common very fine, fine, and medium roots; common very fine and fine tubular pores; medium acid (pH 6.0); clear wavy boundary; 9 to 11 inches thick.

A14-20 to 30 inches; grayish brown (10YR 5/2) very fine sandy loam, very dark brown (10YR 2/2) moist; weak medium and coarse prismatic structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine, fine, and medium roots; many very fine and fine tubular pores; medium acid (pH 5.8); clear wavy boundary; 10 to 13 inches thick

A15-30 to 40 inches; grayish brown (10YR 5/2) silt loam, very dark brown (10YR 2/2) moist with many fine distinct dark brown (7.5YR 4/4) mottles; weak medium and coarse prismatic structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine, fine, and medium roots; many very fine and fine tubular pores; medium acid (pH 5.8); clear wavy boundary; 10 to 13 inches thick.

IIC1- 40 to 51 inches; yellowish brown (10YR 5/4) fine sandy loam, dark brown (10YR 3/3) moist with many fine distinct dark brown (7.5YR 4/4) mottles; weak medium and coarse prismatic structure; slightly hard, very friable; nonsticky and nonplastic; few very fine, fine, and medium roots; common very fine and fine tubular pores; medium acid (pH 5.8); clear wavy boundary; 11 to 15 inches thick.

IIC2-51 to 66 inches; yellowish brown (10YR 5/4) fine sandy loam, dark yellowish brown (10YR 3/4) moist; many fine distinct dark brown (7.5YR 4/4) mottles; massive; soft, very friable, nonsticky and nonplastic; few very fine and fine roots; few very fine and fine tubular pores; medium acid (pH 5.8).

The mollic epipedon is 36 to more than 40 inches thick A buried A1 horizon is present in some pedons. Some pedons have buried layers and thin volcanic ash deposits.

The Ap or A1 horizon has value of 4 or 5 dry. The IIC horizon has hue of 10YR or 2.5YR, value of 5 or 6 dry and 3 or 4 moist, and chroma of 2 to 4 dry and moist.

Moctileme series

The Moctileme series consists of very deep, somewhat poorly drained soils that formed in alluvium and volcanic ash. These soils are on low terraces. They have slopes of 0 to 2 percent. They have a seasonal high water table at a depth of 3 to 4 feet from February to May. They are frequently flooded for brief periods from February to April. The mean annual precipitation is about 27 inches, and mean annual air temperature is about 44 degrees F. Mean annual soil temperature is 44 to 47 degrees.

Moctileme soils are similar to the Lovell soils and are near the Latahco soils. Lovell soils contain less volcanic ash. Latahco soils have a dark gray A horizon.

Typical pedon of Moctileme silt loam, about 2 miles southeast of Desmet, in the northwest corner of sec. 29, T. 44 N., R. 4 W.:

A11-0 to 4 inches; light brownish gray (10YR 6/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak medium and coarse subangular blocky structure parting to weak fine granular; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; many very fine, fine, and medium tubular pores; slightly acid (pH 6.4); clear *wavy* boundary; 4 to 6 inches thick.

A12-4 to 12 inches; light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; weak moderate and coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; many very fine, fine, and medium tubular pores; slightly acid (pH 6.2); abrupt smooth boundary, 8 to 12 inches thick.

A2-12 to 37 inches; light gray (10YR 6/1) very fine sandy loam, grayish brown (2.5Y 5/2) moist; massive; hard, firm, slightly sticky and slightly plastic; few very fine and fine roots; many very fine, fine, and medium tubular pores; neutral (pH 6.8); abrupt smooth boundary; 15 to 25 inches thick.

B2t-37 to 60 inches; very pale brown (10YR 7/3) silty clay loam, light olive brown (2.5Y 5/3) moist; many fine and medium distinct mottles; strong medium and coarse prismatic structure; very hard, very firm, sticky and plastic; few very fine and fine exped roots; many fine and medium tubular pores; thick continuous clay films on faces of peds; many fine and medium black concretions; neutral (pH 7.0).

The A1 horizon has value of 5 or 6 dry. The A2 horizon has hue of 10YR or 2.5YR, value of 5 to 7 dry and 3 to 5 moist, and chroma of 1 to 3 dry or moist. It is silt loam or very fine sandy loam. The B2t horizon has hue of 10YR or 2.5Y, value of 5 to 7 dry and 3 to 5 moist, and chroma of 1 to 3 dry and moist. The B2t horizon has many or common distinct or prominent mottles. It is silt loam.

Naff series

The Naff series consists of very deep, well drained soils that formed in loess. These soils are on loess hills. They have slopes of 7 to 40 percent. The mean annual precipitation is about 20 inches, and mean annual air temperature is about 47 degrees F. Mean annual soil temperature is 47 to 50 degrees.

Naff soils are similar to the Larkin and Taney soils and are near the Garfield, Palouse, Thatuna, and Tilma soils. Larkin soils are silt loam throughout and have a dark grayish brown A horizon that is 17 to 28 inches thick. Garfield soils have a silty clay B horizon. Palouse soils do not have a B2t horizon. Taney, Thatuna, and Tilma soils have an A'2 horizon and are moderately well drained.

Typical pedon of Naff silt loam, about 165 feet west and 1,485 feet south of the northeast corner of sec. 27, T. 45 N., R. 5 W.:

Ap-0 to 8 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak fine and medium subangular blocky structure parting to weak very fine and fine granular; soft, very friable, slightly sticky and slightly plastic; common fine and medium roots; common fine and medium interstitial pores; medium acid (pH 5.8); abrupt smooth boundary; 6 to 8 inches thick.

A11-8 to 13 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; moderate fine and medium subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; few fine and medium roots; common fine and medium tubular pores; slightly acid (pH 6.2); clear smooth boundary; 4 to 6 inches thick.

A3-13 to 18 inches; brown (10YR 5/3) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium prismatic structure parting to moderate medium subangular and angular blocky; slightly hard, friable, slightly sticky and slightly plastic; common fine and medium roots; common fine and medium tubular and interstitial pores; slightly acid (pH 62); gradual smooth boundary; 4 to 6 inches thick.

B1t-18 to 26 inches; pale brown (10YR 6/3) silt loam, dark brown (10YR 4/3) weak medium and fine prismatic structure parting to moderate medium subangular and angular blocky; hard, firm. slightly sticky and slightly plastic; common fine and medium roots; common fine and medium tubular and interstitial pores; common thick vertical and horizontal pressure faces on ped surfaces; few concretions; slightly acid (pH 6.4); gradual smooth boundary; 6 to 8 inches thick.

B21t-26 to 36 inches; pale brown (10YR 6/3) silty clay loam, dark brown (10YR 4/3) moist; weak fine and medium prismatic structure parting to strong fine and medium subangular blocky; hard, firm, sticky and plastic; few fine and very fine roots; many very fine and fine tubular pores; many thick and moderately thick clay films on faces of peds and in pores; common fine, medium, and large black concretions; plentiful bleached sand and silt grains on surfaces of peds; slightly acid (pH 6.5); gradual smooth boundary; 8 to 12 inches thick.

B22t-36 to 52 inches; pale brown (10YR 6/3) silty clay loam, dark brown (7.5YR 5/4) moist; strong medium and coarse prismatic structure parting to strong medium angular and subangular blocky; very hard, very firm, sticky and plastic; few very fine and fine roots; many very fine, fine, and medium tubular pores; many thick and moderately thick clay films on faces of peds and in pores; common fine, medium, and large black concretions; abundant bleached sand and silty grains on surfaces of peds; neutral (pH 6.7); gradual smooth boundary; 12 to 16 inches thick.

B23t-52 to 60 inches; light yellowish brown (10YR 6/4) silty clay loam, yellowish brown (10YR 5/4) moist; strong medium prismatic structure; very hard, very firm, very sticky and very plastic; few very fine and fine roots; many fine and very fine tubular pores; many moderately thick clay films on faces of peds and in pores; common fine, medium, and large black concretions; neutral (pH 6.7).

The solum is 42 to more than 60 inches thick.

The Ap and A1 horizons have value of 4 or 5 dry and 2 or 3 moist and chroma of 1 or 2. The B2t horizon has value of 5 or 6 dry. It averages 27 to 35 percent clay and 5 to 10 percent fine sand or coarser.

Nakarna series

The Nakarna series consists of deep, well drained soils that formed in material weathered from schist and a mantle of volcanic ash and loess. These soils are on mountains. They have slopes of 5 to 65 percent. The mean annual precipitation is about 35 inches, and mean annual air temperature is about 39 degrees F. Mean annual soil temperature is 39 to 43 degrees, and mean summer soil temperature at a depth of 20 inches, in pedons that have an 0 horizon, is 43 to 46 degrees.

Nakarna soils are similar to the Divers, Dorb, Garveson, and Huckleberry soils and are near the Helmer, Pokey, and Potlatch soils. Divers soils average more than 35 percent rock fragments in the B horizon and C horizon above a depth of 40 inches. Dorb soils have basalt at a depth of 20 to 40 inches. Garveson soils have a very gravelly coarse sand C horizon above a depth of 40 inches. Huckleberry soils have weathered shale at a depth of 20 to 40 inches. Helmer soils have a fragipan. Pokey soils are very poorly drained, and Potlatch soils are poorly drained.

Typical pedon of Nakarna silt loam, very steep, near the west fork of Emerald Creek, SE1/4NW1/4 sec. 31, T. 43 N., R. 1 E.:

O11-2.5 inches to 1 inch; undecomposed needles and twigs.

O12-1 inch to 0; partly decomposed needles and twigs.

A2-0 to .5 inch; volcanic ash, discontinuous.

B21ir-.5 inch to 8 inches; yellowish brown (10YR 5/4) silt loam, dark reddish brown (5YR 3/3) moist; weak very fine and fine granular structure; soft, very friable, slightly sticky and slightly plastic; many very fine, fine, and medium, and few coarse roots; many very fine interstitial pores; 5 percent fine gravel; strongly acid (pH 5.4); clear wavy boundary; 7 to 10 inches thick.

B22ir-8 to 15 inches; light yellowish brown (10YR 6/4) silt loam, brown (7.5YR 4/4) moist; weak fine subangular blocky structure parting to weak very fine and fine granular; soft, very friable, slightly sticky and slightly plastic; many very fine, fine, and medium and few coarse roots; many very fine interstitial pores; 5 percent fine gravel; slightly acid (pH 6.4); clear wavy boundary; 7 to 14 inches thick.

IB23-15 to 21 inches; very pale brown (10YR 7/3) fine sandy loam, yellowish brown (10YR 5/4) moist; weak medium subangular blocky structure; soft, very friable, slightly sticky and nonplastic; common very fine, fine, and medium roots; many very fine, fine, and medium tubular pores; 5 percent fine gravel; slightly acid (pH 6:4); clear wavy boundary; 6 to 12 inches thick.

IIB24-21 to 34 inches; very pale brown (10YR 7/3) fine sandy loam, yellowish brown (10YR 5/4) moist; weak medium subangular blocky structure; slightly hard, very friable, slightly sticky and nonplastic; common very fine, fine, and medium roots; many very fine, fine, and medium tubular pores; many wavy discontinuous clayey bands 1/8 to 1/4 inch thick; 10 percent gravel; slightly acid (pH 6.2); clear wavy boundary; 13 to 20 inches thick.

IIC1-34 to 44 inches; very pale brown (10YR 7/4) gravelly fine sandy loam, yellowish brown (10YR 5/6) moist; massive; slightly hard, very friable; few very fine and fine roots; common very fine and fine interstitial pores and few very fine and fine tubular pores; 25 percent gravel; slightly acid (pH (3.4); clear wavy boundary; 10 to 14 inches thick.

IIIC2-44 to 60 inches; variegated very gravelly sandy loam with fragments of partly decomposed schistic bedrock; massive; slightly hard, very friable, nonsticky and nonplastic; few very fine and fine roots; many very fine and fine interstitial pores; 55 percent gravel; neutral (pH 6.8).

In disturbed areas, the thin A2 horizon has been mixed with the B21ir horizon. The B2ir horizon has hue of 10YR, 7.5YR, or 5YR; value of 5 or 6 dry and 3 to 5 moist; and chroma of 4 to 6 dry and 3 to 5 moist. It is as much as 10 percent gravel. The IIB2 horizon has value of 5 to 7 dry and 4 or 5 moist and chroma of 3 or 4. It is 5 to 15 percent gravel. The IIB2 horizon has few to many wavy discontinuous 1/8- to 1/2-inch thick clayey bands. It is silt loam, very fine sandy loam, or fine sandy loam.

The C horizon has dominant hue of 10YR and 2.5Y, value of 6 or 7 dry and 4 or 5 moist, and chroma of 3 or 4 dry and 3 to 6 moist. It is 25 to 80 percent gravel.

Palouse series

The Palouse series consists of very deep, well drained soils that formed in loess and a minor amount of volcanic ash in the upper part. These soils are on loess hills. They have slopes of 3 to 25 percent. The mean annual precipitation is about 20 inches, and mean annual air temperature is about 47 degrees F. Mean annual soil temperature is 48 to 50 degrees.

Palouse soils are similar to the Larkin and Naff soils and are near the Garfield, Thatuna, and Tilma soils. Larkin and Naff soils have a silty clay loam B2t horizon. Garfield soils have a silty clay B2t horizon. Thatuna and Tilma soils have an A'2 horizon and are moderately well drained.

Typical pedon of the Palouse silt loam that has a 6 percent south-facing slope about 440 feet east and 700 feet north of the W IA corner of sec. T. 45 N., R. 5 W.:

Ap-0 to 10 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; moderate fine granular structure; soft, very friable, slightly sticky and slightly plastic; many very fine roots; common very fine and fine tubular pores; neutral 8pH 6.6); abrupt wavy boundary; 6 to 10 inches thick.

A3-10 to 17 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; soft, very friable, slightly sticky and slightly plastic; many very fine roots; common very fine, fine, and medium and few coarse tubular pores; neutral (pH 6.8); clear wavy boundary; 7 to 10 inches thick.

B1-17 to 24 inches; grayish brown (10YR 5/2) silt loam, dark brown (10YR 3/3) moist; weak medium prismatic structure parting to weak medium subangular blocky; soft, very friable, slightly sticky and slightly plastic; many very fine roots; common very fine and fine and few coarse tubular pores; neutral (pH 6.8); clear *wavy* boundary; 7 to 10 inches thick

B21-24 to 36 inches; brown (10YR 5/3) silt loam, dark yellowish brown (10YR 3/4) moist; moderate coarse prismatic structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; common very fine, fine, and coarse tubular pores; many fine black concretions; two clayey bands 1/2 to 1 inch thick; few thin clay films on faces of peds; neutral (pH 7.0); clear wavy boundary; 10 to 14 inches thick.

B22-36 to 50 inches; brown (10YR 5/3) silt loam, dark brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; common very fine, fine, and coarse tubular pores; few thin clay films on faces of peds; few fine black concretions; neutral (pH 7.2); gradual wavy boundary; 10 to 14 inches thick.

B23-50 to 68 inches; yellowish brown (10YR 5/4) silt loam, dark brown (10YR 4/3) moist; moderate fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine, fine, and medium pores; few thin clay films on faces of peds; many fine, medium, and large black concretions; some silt coating on ped surfaces; neutral (pH 7.2).

The solum is 40 to 60 inches thick. The mollic epipedon is 20 to 30 inches thick.

The A horizon has value of 4 or 5 dry and chroma of I or 2 dry and moist. The B horizon has value of 5 or 6 dry. It is mostly silt loam, but ranges to silt.

Pedee series

The Pedee series consists of very deep, moderately well drained soils that formed in colluvium derived from metasedimentary rock with a mantle of loess. These soils are on dissected terraces. They have slopes of 3 to 35 percent. They have a perched water table at a depth of 18 to 24 inches from February to April. Mean annual precipitation is about 25 inches, and mean annual air temperature is about 47 degrees F. Mean annual soil temperature is 48 to 50 degrees.

Pedee soils are similar to the Garfield, Rasser, and Worley soils and are near the McCrosket, Taney, and Tensed soils. Garfield and Worley soils are less than 35 percent gravel in the B horizon. Rasser soils have a pale brown surface layer and a mean annual soil temperature of less than 47 degrees. McCrosket soils have a very gravelly silt loam B horizon and weathered metasedimentary rock at a depth of 40 to 60 inches. Taney and Tensed soils are less than 35 percent gravel above a depth of 40 inches.

Typical pedon of Pedee silt loam, 3 to 25 percent slopes, about 4 miles east of Tensed, in the northeast corner of sec. 16, T. 44 N., R. 4 W.:

A11-0 to 3 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak thin platy structure parting to moderate very fine granular; slightly hard, friable, slightly sticky and slightly plastic; many very fine, fine, medium, and coarse roots; many very fine and fine interstitial pores; medium acid (pH 5.9); clear wavy boundary; 3 to 6 inches thick.

A12-3 to 10 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 3/2) moist; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine, fine, medium, and coarse roots; many very fine and fine interstitial pores; medium acid (pH 5.7); clear wavy boundary; 7 to 10 inches thick.

B2-10 to 19 inches; brown (10YR 5/3) gravely silt loam, dark brown (10YR 4/3) moist; weak medium prismatic structure parting to moderate medium subangular blocky; hard, friable, slightly sticky and slightly plastic; many very fine and fine interstitial pores; few thin clay films on faces of peds and in pores; 30 percent gravel; strongly acid (pH 5.5); abrupt wavy boundary; 9 to 12 inches thick.

A'2-19 to 22 inches; very pale brown (10YR 7/3) very gravelly silt loam, dark brown (10YR 4/3) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few very fine and fine interstitial pores; 35 percent gravel; strongly acid (pH 5.5); abrupt wavy boundary; 2 to 4 inches thick

B'21t-22 to 31 inches; brown (7.5YR 5/4) very gravelly clay, dark brown (7.5YR 4/4) moist; moderate coarse columnar structure parting to moderate coarse angular blocky; extremely hard, very firm, very sticky and very plastic; few very fine and fine roots; few very fine pores; thick continuous clay films on faces of peds; 35 percent gravel; strongly acid (pH 5.1); clear wavy boundary; 9 to 12 inches thick.

B'22t-31 to 41 inches; reddish brown (5YR 4/4) very gravelly clay loam, yellowish red (5YR 5/6) moist; massive; extremely hard, very firm, very sticky and very plastic; few very fine and fine roots; many very fine and fine pores; continuous moderately thick clay bridges between sand grains and gravel; 40 percent gravel; medium acid (pH 5.8); clear wavy boundary; 9 to 11 inches thick.

B'3t-41 to 60 inches; pink (7.5YR 7/4) very gravelly clay loam, brown (7.5YR 5/4) moist; massive; extremely hard, extremely firm, very sticky and very plastic; many very fine and fine pores; continuous moderately thick clay bridges between sand grains and gravel; 65 percent gravel; neutral (pH 6.7).

The solum is more than 60 inches thick.

The Ap or A1 horizon has hue of 10YR or 7.5YR, value of 4 or 5 dry and 2 or 3 moist, and chroma of 2 or 3 dry or moist. The B2 horizon has hue of 10YR or 7.5YR, value of 4 or 5 dry and 3 or 4 moist, and chroma of 3 or 4. The A2 horizon has hue of 7.5YR or 10Y R and value of 6 or 7 dry and 4 or 5 moist. The B'2t horizon has hue of 7.5YR, 5YR, or 2.5YR; value of 6 or 7 dry and 4 or 5 moist; and chroma of 6 to 8. This horizon is 35 to 60 percent coarse fragments.

Pokey series

The Pokey series consists of very deep, very poorly drained soils that formed in alluvium derived from schist. These soils are on low stream terraces and flood plains. They have slopes of 0 to 2 percent. These soils have a seasonal high water table that fluctuates at a depth between 12 and 36 inches during spring. The mean annual precipitation is about 30 inches, and mean annual air temperature is about 41 degrees F. Mean annual soil temperature is 41 to 45 degrees, and mean summer soil temperature is 52 to 54 degrees.

Pokey soils are similar to the Miesen soils and are near the Dorb, Helmer, Nakarna, and Potlatch soils. Miesen soils have a thick silt loam A horizon. Dorb soils are well drained. Helmer soils are moderately well drained. Nakarna soils are well drained. Potlatch soils have an A'2g horizon and a silty clay loam B'2tg horizon.

Typical pedon of Pokey fine sandy loam, about 1,220 feet south and 800 feet west of the northeast corner of sec. 8, T. 43 N., R. 1 E.:

A1-0 to 7 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist with common distinct dark yellowish brown (10YR 4/4) mottles; weak medium subangular blocky structure parting to moderate fine and medium granular ; slightly hard, friable, nonsticky and nonplastic; many very fine and fine roots; many very fine and fine tubular pores; many mica flakes; neutral (pH 6.8); abrupt smooth boundary; 6 to 8 inches thick.

A12-7 to 17 inches; grayish brown (10YR 5/2) fine sandy loam, dark brown (10YR 3/3) moist with common distinct dark yellowish brown (10YR 4/4) mottles; weak coarse subangular blocky structure; soft, very friable, nonsticky and nonplastic; many very fine and fine roots; many very fine and fine tubular pores; many mica flakes; neutral (pH 7.0); gradual wavy boundary; 6 to 10 inches thick

Clg-17 to 24 inches; light brownish gray (2.5Y 6/2) fine sandy loam, dark grayish brown (2.5Y 4/2) moist with many prominent dark yellowish brown (10YR 4/4) mottles; massive; soft, very friable, nonsticky and nonplastic; common very fine roots; many very fine tubular pores; many mica flakes; neutral (pH 6.8); abrupt wavy boundary; 7 to 22 inches thick

IIC2g-24 to 60 inches; light and dark colored coarse sand and gravel; many prominent dark yellowish brown (10YR 4/4) mottles; single grain; loose when dry and moist; neutral (pH 7.0).

The mollic epipedon is 12 to 18 inches thick. Some pedons have a buried A horizon.

The A horizon has value of 2 or 3 moist and 4 or 5 dry. This horizon has faint or distinct mottles. It is fine sandy loam, or very fine sandy loam. The C horizon has hue of 10YR or 2.5Y, value of 5 or 6 dry, and chroma of 2 or 3. It is fine sandy loam or sandy loam.

Porrett series

The Porrett series consists of very deep, very poorly drained soils that formed in loess and volcanic ash alluvium. These soils are on alluvial bottom lands. They have slopes of 0 to 2 percent. These soils have a seasonal high water table that ranges from the surface to a depth of 12 inches from April to June and are frequently flooded for brief periods from February to April. The mean annual precipitation is about 30 inches, and mean annual air temperature is about 42 degrees F. Mean annual soil temperature is 43 to 45 degrees, and mean summer soil temperature, in pedons that have no 0 horizon, is 48 to 53 degrees.

Porrett soils are similar to the Potlatch soils and are near the Benewah, Moctileme, and Rasser soils. Potlatch soils have a very dark grayish brown A horizon and average more than 35 percent clay in the B horizon. Benewah soils are moderately well drained. Moctileme soils do not have mottles above a depth of 27 inches. Rasser soils are well drained and are more than 35 percent coarse fragments in the B horizon.

Typical pedon of Porrett silt loam, near Benewah about 100 feet southwest of schoolhouse, NW1/4SW1/4 sec. 24, T. 45 N., R. 4 W.:

Ap-0 to 3 inches; gray (10YR 6/1) silt loam, very dark grayish brown (10YR 3/2) moist; few fine faint brown mottles; weak thin platy structure parting to moderate very fine granular; soft, very friable, slightly sticky and slightly plastic; many very fine and fine and few medium and coarse roots; many very fine and fine interstitial pores; medium acid (pH 5.8); abrupt smooth boundary; 0 to 4 inches thick.

A21-3 to 9 inches; light gray (10YR 7/2) silt loam, brown (10YR 5/3) moist with common fine and medium distinct light yellowish brown (10YR 6/4) mottles; moderate thin and medium platy structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine and few medium and coarse roots; many very fine and fine tubular pores; many medium black concretions; very strongly acid (pH 4.8); abrupt smooth boundary; 4 to 7 inches thick.

A22-9 to 14 inches; light gray (10YR 7/2) silt loam, light olive brown (2.5Y 5/3) moist with common fine and medium distinct light yellowish brown (10YR 6/4) mottles; massive; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; many very fine and fine tubular pores; many medium black concretions; medium acid (pH 5.6); abrupt smooth boundary; 4 to 6 inches thick

A23-14 to 17 inches; light gray (10YR 7/1) silt loam, grayish brown (2.5Y 5/2) moist; common fine and medium distinct light yellowish brown (10YR 6/4) mottles; massive; slightly hard, friable; few very fine and fine roots; many very fine and fine and few coarse tubular pores; many medium black concretions; medium acid (pH 6.0); abrupt smooth boundary; 3 to 6 inches thick.

A24-17 to 21 inches; light gray (10YR 7/1) silt loam, pale brown (10YR 6/3) moist; common fine and medium distinct light yellowish brown (10YR 6/4) mottles massive slightly hard, friable; few very fine and fine roots; many very fine and fine tubular pores; many medium black concretions; medium acid (pH 5.9); abrupt smooth boundary; 4 to 8 inches thick.

B21tg-21 to 23 inches; light gray (2.5Y 7/2) silty clay loam, grayish brown (10YR 5/2) moist; common fine and medium distinct light yellowish brown (10YR 6/4) mottles; strong very coarse prismatic structure parting to moderate coarse angular blocky; very hard, firm, sticky and plastic; few exped roots; many very fine and fine tubular pores; many thick very dark gray (10YR 3/1) clay films on vertical faces of peds and in pores; many medium and few large black concretions; slightly acid (pH 62); abrupt smooth boundary; 2 to 5 inches thick.

B22t-23 to 36 inches; light gray (10YR 7/2) silty clay loam, olive brown (2.5Y 4/3) moist; many medium distinct dark yellowish brown (10YR 4/4) mottles; moderate very coarse prismatic structure parting to moderate coarse angular blocky; very hard, firm, sticky and plastic; few exped roots; many very fine and fine tubular pores; many thick very dark gray (10YR 3/1) clay films on vertical faces of peds and in pores; many medium and few large black concretions; neutral (pH 6.6); clear smooth boundary; 13 to 20 inches thick.

B3t-36 to 60 inches; light yellowish gray (10YR 6/2) silty clay loam, light olive brown (2.5Y 5/3) moist; many medium and coarse distinct strong brown (7.5YR 5/6) mottles; moderate very coarse prismatic structure; very hard, firm, sticky and very plastic; many very fine and fine and few medium pores; many thick continuous clay films on vertical faces of peds and in pores; many medium and few coarse black concretions; neutral (pH 6.6).

The solum is 54 to more than 60 inches thick.

The Ap horizon has hue of 10YR or 2.5Y and chroma of 1 or 2. The A2 horizon has hue of 10YR or 2_5Y, value of 5 to 7 dry and 4 or 5 moist, and chroma of 1 to 3 dry and 2 or 3 moist. The B2tg and B2t horizons have hue of 10YR or 2.5Y, value of 5 to 7 dry and 4 to 6 moist, and chroma of 1 to 3.

Potlatch series

The Potlatch series consists of very deep, poorly drained soils that formed in alluvium. These soils are on alluvial fans and terraces. They have slopes of 0 to 2 percent. These soils have a seasonal high water table that fluctuates between 18 and 42 inches from the surface from February to July. They are subject to annual flooding for long periods from February to May. The mean annual precipitation is about 30 inches, and mean annual air temperature is about 42 degrees F. Mean annual soil temperature is 43 to 46 degrees, and mean summer soil temperature is 52 to 54 degrees.

Potlatch soils are similar to the Chatcolet and Porrett soils and are near the Helmer, Pokey, and Nakarna soils. Chatcolet soils are moderately well drained. Porrett soils average less than 35 percent clay in the B horizon. Helmer soils are moderately well drained. Pokey soils have a fine sandy loam Al horizon and do not have an A'2 or B2t horizon. Nakarna soils are well drained.

Typical pedon of Potlatch silt loam, in a meadow at the east end of the strip mine, on the west fork of Emerald Creek in NW 1/4NE1/4SE 1/4 sec. 33, T. 43 N., R. 1 E.:

A1-0 to 5 inches; very dark grayish brown (10YR 3/2) silt loam, black(10YR 2/1) moist; moderate fine subangular blocky structure parting to moderate fine granular; hard, firm, slightly sticky and slightly plastic; many very fine, fine, and medium roots; many very fine tubular pores; strongly acid (pH 5.5); clear wavy boundary; 5 to 10 inches thick.

B2t-5 to 14 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark gray (10YR 3/1) moist with common fine distinct mottles; moderate coarse prismatic structure; extremely hard, very firm, sticky and plastic; many very fine, fine, and medium roots; many very fine and fine tubular pores; thick continuous clay films on faces of peds; medium acid (pH 6.0); clear wavy boundary; 9 to 16 inches thick.

A'2g-14 to 19 inches; light gray (2.5Y 7/2) silt, light brownish gray (2.5Y 6/2) moist with many fine and few medium distinct mottles; massive; hard, firm; few very fine roots; medium very fine tubular pores; medium acid (pH 6.0); clear wavy boundary; 5 to 7 inches thick.

B'21tg-19 to 30 inches; light brownish gray (2.5Y 6/2) silty clay loam, grayish brown (2.5Y 5/2) moist with many medium and coarse prominent mottles; moderate coarse prismatic structure; extremely hard, very firm, sticky and plastic; few fine exped roots; many very fine and fine tubular pores; thick continuous clay films on faces of peds and in pores; neutral (pH 7.0); gradual wavy boundary; 9 to 15 inches thick.

B'22tg-30 to 40 inches; light brownish gray (2.5Y 6/2) silty clay loam, grayish brown (2.5Y 5/2) moist with many medium and coarse prominent mottles; moderate coarse prismatic structure; extremely hard, very firm, sticky and plastic; few fine exped roots; many very fine and fine tubular pores; thick continuous clay films on faces of peds; neutral (pH 7/2); abrupt wavy boundary; 8 to 12 inches thick.

C1-40 to 43 inches; yellowish red (5YR 5/8) very fine sandy loam, dark red (2.5Y 3/6) moist; massive; soft, very friable, slightly sticky and slightly plastic; many very fine and fine tubular pores; strongly acid (pH 5.2); abrupt wavy boundary; 0 to 3 inches thick.

C2g-43 to 46 inches; light gray (2.5Y 7/2) very fine sandy loam, olive gray (5Y 5/2) moist with many medium and coarse distinct mottles; very hard, very friable, slightly plastic; many very fine and fine tubular pores; neutral (pH 6.8); abrupt wavy boundary; 3 to 5 inches thick.

C3g-46 to 60 inches; light olive gray (5Y 6/2) very fine sandy loam, dark greenish gray (5BG 4/1) moist; massive; very hard, very friable, slightly plastic; many very fine and fine tubular pores; neutral (pH 6.6).

The solum is 36 to 60 inches thick.

The Al horizon has value of 2 or 3 moist and 3 to 5 dry and chroma of 1 or 2 moist and dry. In some pedons this horizon has faint mottles. The B2t horizon has value of 3 or 4 moist and 4 to 6 dry and chroma of 1 to 3. This horizon has few to many, faint or distinct mottles. It is silt loam or silty clay loam. The A'2 horizon has hue of 2.5Y or 5Y, value of 4 to 6 moist and 5 to 7 dry, and chroma of 1 or 2. This horizon has distinct or prominent mottles that have hue of 10YR or 7.5YR, value of 4 or 5 moist and 5 or 6 dry, and chroma of 4 to 6. It is silt or silt loam. The B'2tg horizon has hue of 10YR to 5Y, value of 5 or 6 moist and 6 or 7 dry, and chroma of 1 to 3. This horizon has common or many, distinct or prominent mottles that have hue of 5YR to 10YR, value of 4 or 5 moist and 5 or 6 dry, and chroma of 4 to 6 moist and dry. It is silty clay loam to silty clay. The C horizon is silt, silt loam, or very fine sandy loam.

Pywell series

The Pywell series consists of very deep, very poorly drained soils that formed in organic materials. These soils are in depressions of flood plains and bottom lands. These soils have a seasonal high water table at a depth of 0 to 24 inches in spring, and are subject to flooding if not protected by dikes or levees. These soils form cracks that are 1/4 to 1 inch wide when dry. The mean annual precipitation is about 25 inches, and mean annual air temperature is about 43 degrees F. Mean annual soil temperature is 44 to 46 degrees.

Pywell soils are similar to the DeVoignes soils and are near the Miesen and Ramsdell soils. DeVoignes soils have a silt loam A horizon and a silty clay loam C horizon at a depth of 15 to 34 inches. Miesen and Ramsdell soils are mineral soils.

Typical pedon of Pywell muck, on a 2 percent slope, about 150 feet from the east end of runway at St. Maries Airport, 200 feet west and 100 feet south of NIA corner of sec. 22, T. 46 N., R. 2 W.:

Oa1-0 to 12 inches; dark reddish brown (5YR 2/2) broken face and dark brown (7.5YR 3/2) rubbed, sapric material; about 25 percent fibers, about 5 percent after rubbing; moderate medium subangular blocky structure parting to strong medium granular; many fine and medium roots; *very* strongly acid (pH 5.0); abrupt wavy boundary; 8 to 12 inches thick.

Oa2-12 to 16 inches; grayish brown (2.5Y 5/2) broken face and very dark grayish brown (10YR 3/2) rubbed, sapric material; about 15 percent fibers, about 5 percent after rubbing; weak medium prismatic structure; many fine and medium roots; very strongly acid (pH 4.6); abrupt wavy boundary; 3 to 10 inches thick.

Oa3-16 to 47 inches; dark reddish brown (5YR 2/2) broken face and black (5YR 2/1) rubbed, sapric material; about 15 percent fibers, less than 5 percent after rubbing; weak medium prismatic structure; very strongly acid (pH 4.8); abrupt wavy boundary; 18 to 31 inches thick.

Oa4-47 to 65 inches; grayish brown (2.5Y 5/2) broken face and rubbed, sapric material; about 20 percent fibers, less than 5 percent after rubbing; massive; very strongly acid (pH 4.8).

The organic layers are 60 inches or more thick. They are commonly derived from herbaceous plants, but in some pedons a moderate amount of material is woody.

The surface tier is dominated by sapric material, but some pedons have thin lavers of fabric material. The subsurface and bottom tiers have thin layers of mineral soil, volcanic ash, and fibric material.

Ramsdell series

The Ramsdell series consists of very deep, very poorly drained soils that formed in alluvium. These soils are on low terraces. They have slopes of 0 to 2 percent. These soils have a seasonal high water table at a depth of 0 to 2 feet from February to April. They are frequently flooded during spring for long periods, unless protected by levees. The mean annual precipitation is about 29 inches, and mean annual air temperature is about 44 degrees F. Mean annual soil temperature is 45 to 47 degrees.

Ramsdell soils are similar to the DeVoignes soils and are near the Chatcolet, Miesen, and Pywell soils. DeVoignes soils have organic layers. Chatcolet soils are moderately well drained and are on glaciolacustrine terraces. Miesen soils have a mollic epipedon. Pywell soils are organic.

Typical pedon of Ramsdell silt loam, about 1.5 miles west of St. Maries, 2,115 feet west and 705 feet south of the northeast corner of sec. 20, T. 46 N., R. 2 W.:

Ap-0 to 8 inches; light gray (2.5Y 7/2) silt loam, grayish brown (2.5Y 5/2) moist; moderate fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine, fine, and medium roots; common very fine tubular pores; medium acid (pH 6.0); abrupt boundary; 8 to 10 inches thick.

B21g-8 to 15 inches; light gray (2.5Y 7/2) very fine sandy loam, grayish brown (2.5Y 5/2) moist with many medium prominent brown (7.5YR 5/4) mottles; moderate fine prismatic structure parting to weak coarse subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; common fine and few medium tubular pores; slightly acid (pH 6.4); abrupt boundary; 7 to 16 inches thick.

B22g-15 to 26 inches; light gray (10YR 7/1) silt loam, grayish brown (10YR 5/2) moist with many prominent strong brown (7.5YR 5/6) mottles; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; many fine and common medium tubular pores; medium acid (pH 6.0); abrupt boundary; 6 to 11 inches thick_

B23g-26 to 35 inches; light gray (10YR 7/1) silt loam, grayish brown (10YR 5/2) moist with many prominent reddish yellow (7.5YR 6/6) mottles; moderate coarse prismatic structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine and fine roots; many very fine and fine and common medium tubular pores; medium acid (pH 5.8); abrupt boundary; 9 to 12 inches thick.

Cg-35 to 60 inches; light gray (10YR 7/1) silt loam, grayish brown (10YR 5/2) moist with many prominent reddish yellow (7.5YR 6/6) mottles; massive; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine and few medium tubular pores; medium acid (pH 6.0).

A buried Al horizon is present in some pedons. The Ap horizon has hue of 10YR or 2.5Y and value of 6 or 7 dry and 3 to 5 moist. The Bg horizon has hue of 10YR or 2.5Y and value of 5 to 7 dry and 4 or 5 moist. The Cg horizon has value of 5 to 7 dry and 4 or 5 moist.

Passer series

The Rasser series consists of deep, well drained soils that formed in loess and underlying mudflows. These soils are on foot slopes. They have slopes of 5 to 35 percent. The mean annual precipitation is about 28 inches, and mean annual air temperature is about 43 degrees F. Mean annual soil temperature is 44 to 46 degrees.

Rasser soils are similar to the Benewah and Lovell soils and are near the Huckleberry and Santa soils. Benewah and Lovell soils are less than 35 percent coarse fragments in the B horizon. Huckleberry soils have weathered shale at a depth of 20 to 40 inches. Santa soils have a fragipan.

Typical pedon of Rasser silt loam, 5 to 20 percent slopes, about 0.5 mile south of Benewah, 2,580 feet west and 700 feet south of the northeast corner of sec. 25, T. 45 N., R. 4 W.:

A11-0 to 6 inches; pale brown (10YR 6/3) silt loam, dark brown (10YR 3/3) moist; moderate fine and medium granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine, fine, and medium roots; many very fine and fine tubular pores; 5 percent gravel; strongly acid *(pH 5.2);* clear wavy boundary; 2 to 6 inches thick.

A12-6 to 12 inches; light yellowish brown (10YR 6/4) silt loam, dark yellowish brown (10YR 3/4) moist; weak coarse prismatic structure parting to moderate fine granular; slightly hard, friable, slightly sticky and slightly plastic; many very fine, fine, and medium roots; many very fine, fine, and medium tubular pores; 5 percent gravel; very strongly acid *(pH 4.8);* clear wavy boundary; 5 to 7 inches thick

B21t-12 to 20 inches; pale brown (JOYR 6/3) clay loam, brown (7.5YR 4/2) moist; weak coarse subangular blocky structure; hard, firm, sticky and plastic; many very fine, fine, and medium roots; many very fine, fine, and medium tubular pores; thin patchy clay films on faces of pods; 5 percent gravel; *very* strongly acid (pH 4.8); clear wavy boundary; 7 to 10 inches thick.

IIB22t-20 to 30 inches; light yellowish brown (10YR 6/4) very cobbly clay loam, brown (7.5YR 4/4) moist; weak medium subangular blocky structure; hard, firm, sticky and plastic; many fine, fine, and medium roots; many very fine, fine, and medium tubular pores; thin patchy clay films on faces of peds; 60 percent cobbles; 5 percent gravel; very strongly acid (pH 4.8); abrupt wavy boundary; 9 to 13 inches thick.

IIB3t-30 to 60 inches; very pale brown (10YR 7/3) very gravelly clay loam, brown (10YR 5/3) moist; massive; hard, firm, sticky and plastic; few very fine and fine roots; thin patchy clay films, in pores; 75 percent gravel; very strongly acid (pH 4.8).

Base saturation is less than 75 percent throughout the upper 30 inches of the soil profile. The solum is 40 to 60 inches thick.

An 0 horizon, 1 to 2.5 inches thick, is present if the soil has not been disturbed. The Al horizon has hue of 10YR or 7.5YR, value of 5 or 6 dry, and chroma of 3 or 4. The Al and B2t horizons are 0 to 15 percent gravel. The B2t horizon has hue of 10YR or 7.5YR, value of 6 or 7 dry and 4 or 5 moist, and chroma of 2 to 4. The IIB2t horizon is 50 to 70 percent coarse fragments.

Santa series

The Santa series consists of very deep, moderately well drained soils that formed in loess and a minor amount of volcanic ash. These soils are on loess hills. They have slopes of 3 to 35 percent. The mean annual precipitation is about 27 inches, and mean annual air temperature is about 43 degrees F. Mean annual soil temperature is 44 to 46 degrees.

Santa soils are similar to the Helmer soils and are near the Benewah, Rasser, and Taney soils. Helmer soils contain more volcanic ash and have a bulk density in the upper 20 inches of less than 0.95 grams per centimeter. Benewah, Rasser, and Taney soils do not have a fragipan.

Typical pedon of Santa silt loam, on a 2 percent east facing slope, 50 feet west of U.S. Highway 95, 2,580 feet east and 40 feet north of the southwest corner of sec. 3, T. 43 N., R. 4 W.:

O1-1.5 inches to 1 inch; undecomposed and partly decomposed pine needles and twigs.

O2-1 inch to 0; decomposed organic matter.

Al-0 to 4 inches; light brownish gray (10YR 6/2) silt loam, dark brown (10YR 4/3) moist; weak very thin platy 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 fine tubular pores; medium acid (pH 5.7); clear wavy boundary; 4 to 10 inches thick.

A3-4 to 9 inches; light gray (10YR 7/2) silt loam, dark brown (10YR 4/3) moist; weak fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine, fine, and medium roots; common very fine and fine tubular pores; medium acid (pH 6.0); gradual wavy boundary; 5 to 10 inches thick.

B2-9 to 15 inches; light *gray* (10YR 7/2) silt loam, brown (10YR 4/3) moist; weak medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common very fine and fine and few medium and coarse roots; many very fine and fine and few medium tubular pores; medium acid (pH 6.0); clear wavy boundary; 6 to 7 inches thick.

A'21-15 to 21 inches; light gray (10YR 7/2) silt loam, brown (10YR 5/3) moist; massive; hard, friable, slightly sticky and slightly plastic; common very fine and fine and few medium and coarse roots; many very fine, fine, and medium tubular pores; many black concretions; many medium distinct mottles in lower part; medium acid (pH 5.7); clear wavy boundary; 6 to 7 inches thick.

A'22-21 to 34 inches; light gray (10YR 7/2) silt, light brownish gray (10YR 6/2) moist; massive; hard, friable, slightly sticky and slightly plastic; few very fine, fine, and medium roots; common very fine and fine tubular pores; many black concretions; many medium distinct mottles; strongly acid (pH 5.5); abrupt wavy boundary; I inch to 14 inches thick.

B'21tx-34 to 44 inches; yellowish brown (10YR 5/4) silty clay loam, dark yellowish brown (10YR 4/4) moist; strong medium prismatic structure parting to strong medium angular blocky; very hard, very firm, sticky and plastic; few very fine, medium, and coarse exped roots: few fine and medium vesicular pores; common thin clay films on faces of peds and in pores; bleached silt coatings on peds; strongly acid (pH 5.5); gradual wavy boundary; 8 to 10 inches thick.

B'22tx-44 to 60 inches; pale brown (10YR 6/3) silty clay loam, yellowish brown (10YR 5/4) moist: strong medium and coarse prismatic structure parting to strong medium and coarse angular blocky; very hard, very firm, sticky and plastic; few fine, medium, and coarse expel roots; few fine and medium vesicular pores; many thick clay films on peels and in pores; many black concretions; medium acid (pH 5.9).

Depth to the fragipan ranges from 22 to 36 inches.

The A horizon has value of 5 to 7 dry and chroma of 2 to 4 dry and moist. The B2 horizon has value of 6 or 7 dry. The A'2 horizon has hue of 10YR or 2.5Y. The B'2tx horizon has hue of 10YR or 7.5YR and value of 3 to 5 moist. It is dense, brittle silt loam or silty clay loam.

Santa Variant

The Santa Variant consists of moderately deep, moderately well drained soils that formed in loess deposits over fractured basalt or metasedimentary rock. These soils are on loess hills. They have slopes of 5 to 20 percent. The mean annual precipitation is about 27 inches, and mean annual air temperature is about 43 degrees F. Mean annual soil temperature is 44 to 46 degrees.

Santa Variant soils are similar to the Santa and Helmer soils and are near the Benewah, Rasser, and Taney soils. Santa and Helmer soils do not have bedrock above a depth of 60 inches. Benewah, Rasser, and Taney soils do not have a fragipan.

Typical pedon of Santa Variant silt loam, about 2,000 feet west and 1,100 feet north of the southeast corner of sec. 30, T. 46 N., R. 2 W.:

O1-1 inch to 0; partly decomposed pine needles.

A1-0 to 3 inches; light brownish gray (10YR 6/2) silt loam, dark brown (10YR 4/3) moist; weak thin platy 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 fine tubular pores; medium acid (pH 5.8); clear wavy boundary; 2 to 4 inches thick.

A3-3 to 9 inches; light gray (10YR 7/2) silt loam, dark brown (10YR 4/3) moist; weak fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine, fine, and medium roots; common very fine and fine tubular pores; medium acid (pH 6.0); clear wavy boundary; 4 to 6 inches thick

B2-9 to 15 inches; light gray (10YR 7/2) silt loam, brown (10YR 4/3) moist; weak medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common very fine and fine and few medium roots; many very fine and fine and few medium tubular pores; medium acid (pH 6.0); clear wavy boundary; 6 to 7 inches thick.

A2b-15 to 23 inches; light gray (10YR 7/2) silt loam, light brownish gray (10YR 6/2) moist; massive; hard, friable, slightly sticky and slightly plastic; few very fine, fine, and medium roots; common very fine and fine tubular pores; many fine black concretions; many medium distinct mottles; strongly acid (pH 5.5); abrupt wavy boundary; 4 to 8 inches thick.

Bxb-23 to 36 inches; yellowish brown (10YR 5/4) silty clay loam, dark yellowish brown (10YR 4/4) moist; moderate medium prismatic structure parting to strong medium angular blocky; very hard, very firm and brittle, sticky and plastic; few fine medium and coarse roots matted on peds; few fine and medium vesicular pores; common thin clay films on peds and in pores; bleached silt coatings on peds; strongly acid (pH 5.5); clear wavy boundary; 6 to 15 inches thick.

R-36 inches; fractured basalt.

Depth to the fragipan is 16 to 25 inches, and depth to hard bedrock is 20 to 40 inches.

The A horizon has value of 5 to 7 dry and chroma of 2 to 4 dry and moist. The B2 horizon has value of 6 or 7 dry. The A2b horizon has hue of 10YR or 2.5Y. The Bxb horizon has hue of 10YR or 7.5YR and value of 3 to 5 moist.

Schumacher series

The Schumacher series consists of deep, well drained soils that formed in loess and material weathered from metasedimentary rock. These soils are on loess-covered mountain foot slopes. They have slopes of 7 to 40 percent. The mean annual precipitation is about 20 inches, and mean annual air temperature is about 47 degrees F. Mean annual soil temperature is 47 to 52 degrees.

Schumacher soils are similar to the Bobbitt and Tekoa soils and are near the McCrosket, Naff, and Southwick soils. Bobbitt, McCrosket, and Tekoa soils average more than 35 percent rock fragments in the B horizon. Naff and Southwick soils are very deep and do not have rock fragments.

Typical pedon of Schumacher silt loam, about 1,920 feet east and 1,350 feet north of the southwest corner of see. 7, T. 44 N., R. 5 W.:

A11-0 to 7 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak fine and very fine granular structure; soft, very friable, slightly sticky and slightly plastic; many fine and very fine roots; many very fine interstitial pores; 10 percent fine gravel; neutral (pH 6.7); clear smooth boundary; 4 to 7 inches thick.

A12-7 to 12 inches; dark grayish brown (10YR 4/2) silt loam; very dark brown (10YR 2/2) moist; weak fine subangular blocky structure parting to weak fine granular; slightly hard, very friable, slightly sticky and slightly plastic; many fine and very fine roots; many very fine interstitial pores; neutral (pH 6.8); abrupt smooth boundary; 4 to 5 inches thick

B1-12 to 18 inches; brown (10YR 5/3) stony silt loam, dark brown (10YR 3/3) moist; weak fine subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common fine and very fine roots; many very fine tubular pores; 15 percent rock fragments; neutral (pH 6.9); clear smooth boundary; 4 to 6 inches thick.

B21t-18 to 24 inches; yellowish brown (10YR 5/4) stony silty clay loam, brown (10YR 4/3) moist; weak medium and fine subangular blocky structure; very hard, friable, sticky and plastic; common fine and very fine roots; many very fine and fine tubular pores; few thin clay films on faces of peds and in pores; 20 percent rock fragments; neutral (pH 7.0); clear smooth boundary; 4 to 6 inches thick.

B22t-24 to 36 inches; yellowish brown (10YR 5/4) gravelly clay loam, dark brown (10YR 4/3) moist; moderate medium subangular blocky structure; very hard, firm, sticky and plastic; few fine and very fine roots; many very fine and few fine tubular pores; few thin clay films on faces of peds and in pores; 20 percent rock fragments; neutral (pH 7.0); abrupt smooth boundary; 4 to 12 inches thick.

B23t-36 to 40 inches; light yellowish brown (10YR 6/4) gravelly clay loam, brown (7.5YR 4/4) moist; moderate medium subangular blocky structure; very hard, firm, sticky and plastic; few fine and very fine roots; common fine and very fine tubular pores; continuous thin clay films in pores; 25 percent rock fragments; neutral (pH 7.1); abrupt smooth boundary; 0 to 4 inches thick

Cr-40 to 60 inches; weathered quartzite; neutral (pH 7.2).

Depth to weathered metasedimentary rock is 40 to 60 inches.

The A horizon has value of 4 or 5 dry and 2 or 3 moist and chroma of 2 or 3. It is silt loam or loam. It is 5 to 10 percent coarse fragments. The B2t horizon is 10 to 30 percent rock fragments.

Setters series

The Setters series consists of very deep, moderately well drained soils that formed in deep loess. These soils are on loess hills. They have slopes of 3 to 20 percent.

They have a perched water table at a depth of 12 to 18 inches from February to April. The mean annual precipitation is about 25 inches, and mean annual air temperature is about 44 degrees F. Mean annual soil temperature is 45 to 47 degrees.

Setters soils are similar to the Tilma and Worley soils and are near the Pedee, Taney, and Tensed soils. Tilma soils have a grayish brown B2 horizon. Worley soils have a mean annual soil temperature of more than 47 degrees. Pedee soils have a very gravelly clay B2t horizon. Taney and Tensed soils average less than 35 percent clay in the B horizon.

Typical pedon of Setters silt loam, on a 5 percent slope, about 2,020 feet east and 15 feet north of the southwest corner of sec. 17, T. 44 N., R. 4 W.:

Ap-0 to 8 inches; brown (10YR 5/3) silt loam, dark brown (10YR 3/3) moist; weak very fine and fine subangular blocky structure parting to weak very fine and fine granular; soft, very friable, slightly sticky and slightly plastic; few very fine and fine roots; many very fine and fine tubular pores; slightly acid (pH 6.4); abrupt wavy boundary; 6 to 8 inches thick.

A12-8 to 12 inches; brown (10YR 5/3) silt loam, dark brown (10YR 3/3) moist; weak very fine and fine subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; few very fine and fine roots; common very fine and fine tubular pores; neutral (pH 6.6); clear wavy boundary; 4 to 6 inches thick.

B2-12 to 18 inches; pale brown (10YR 6/3) silt loam, dark brown (10YR 4/3) moist; moderate fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; few fine roots; common very fine and few fine tubular pores; few thin clay films on faces of peds and in pores; neutral (pH 6.8); abrupt wavy boundary; 4 to 6 inches thick.

A'2-18 to 20 inches; very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; few very fine tubular pores; neutral (pH 6.8); clear wavy boundary; 1 to 5 inches thick.

B'21t-20 to 28 inches; light yellowish brown (10YR 6/4) silty clay, dark yellowish brown (10YR 4/4) moist; moderate medium prismatic structure; very hard, very firm, sticky and plastic; few fine roots; common very fine and few fine tubular pores; few black concretions; continuous thick dark brown (10YR 3/3) clay films on faces of peds; thin coatings of material from the A'2 horizon on faces of peds in upper part of horizon; slightly acid (pH 6.4); gradual wavy boundary; 6 to 13 inches thick

B'22t-28 to 35 inches; yellowish brown (10YR 5/4) silty clay, dark yellowish brown (10YR 4/4) moist; moderate medium prismatic structure; very hard, very firm, sticky and plastic; few very fine tubular pores; common black concretions; common thick dark brown (10YR 3/3) clay films on faces of peds; slightly acid (pH 6.4); gradual wavy boundary; 5 to 10 inches thick.

B'23t-35 to 60 inches; yellowish brown (10YR 5/4) silty clay, dark yellowish brown (10YR 4/4) moist; moderate medium prismatic structure; very hard, firm, sticky and plastic; few very fine tubular pores; few black concretions; continuous thick dark brown (10YR 3/3) clay films on faces of peds; neutral (pH 7.0).

The solum is 60 inches or more thick.

In undisturbed pedons an 0 horizon is present. The A horizon has value of 4 or 5 dry and 2 or 3 moist and chroma of 2 or 3. The B2 horizon has value of 5 or 6 dry and 3 or 4 moist. The A'2 horizon has value of 6 to 8 dry and 5 or 6 moist. The B'2t horizon has hue of 10YR or 7.5YR, value of 4 or 5 moist, and chroma of 3 or 4 dry and moist.

Southwick series

The Southwick series consists of very deep, moderately well drained soils that formed in loess. These soils are on loess hills. They have slopes of 3 to 40 percent. They have a perched water table at a depth of 36 to 42 inches from February to April. The mean annual precipitation is about 23 inches, and mean annual air temperature is about 46 degrees F. Mean annual soil temperature is 47 to 49 degrees.

Southwick soils are similar to the Tensed, Taney, and Thatuna soils and are near the Taney, Larkin, Latahco, and Worley soils. Tensed and Thatuna soils have value of 5 dry in the B2 horizon. Latahco soils are somewhat poorly drained. Larkin soils do not have an A2 horizon. Worley soils have a silty clay B2t horizon. Taney soils have a mean annual soil temperature of less than 47 degrees F.

Typical pedon of Southwick silt loam, about 1,080 feet south and 380 feet east of the northwest corner of see. 30, T. 44 N, R. 4 W.:

O1-1.5 inches to 0.5 inch; needles, leaves, and twigs.

O2-0.5 inch to 0; decomposed needles, leaves, and twigs.

All-0 to 10 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; moderate fine and medium granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine, fine, and medium roots; many fine interstitial pores; medium acid (pH 6.0); clear smooth boundary; 6 to 12 inches thick.

A12-10 to 18 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine, fine, and medium roots; common very fine and fine tubular pores; medium acid (pH 6.0); diffuse smooth boundary; 6 to 14 inches thick.

B2-18 to 24 inches; brown (10YR 5/3) silt loam, dark brown (10YR 313) moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine, fine, and few medium roots; many very fine, common fine, and few medium tubular pores; medium acid (pH 6.0); clear smooth boundary; 4 to 14 inches thick.

A'2-24 to 32 inches; light gray (10YR 7/2) silt loam, brown (10YR 5/3) moist; weak medium prismatic structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; many very fine tubular pores; common fine concretions; medium acid (pH 6.0); clear wavy boundary; 4 to 8 inches thick

B'21t-32 to 47 inches; brown (10YR 5/3) silty clay loam, dark brown (10YR 4/3) moist; strong medium and coarse prismatic structure; very hard, very firm, sticky and plastic; common very fine and fine exped roots; many very fine and fine tubular pores; common fine concretions; common thick clay films on faces of peds; bleached sand and silt on peds and in pores; slightly acid (pH 6.2); diffuse smooth boundary; 10 to 16 inches thick.

B'22t-47 to 60 inches; yellowish brown (10YR 5/4) silty clay loam, dark yellowish brown (10YR 4/4) moist; moderate medium and coarse prismatic structure; very hard, very firm, sticky and plastic; few very fine and fine exped roots; many very fine and fine tubular pores; common fine concretions; common thick clay films on faces of peds; slightly acid (pH 6.4); gradual smooth boundary; 6 to 14 inches thick.

B3t-60 to 70 inches; pale brown (10YR 6/3) silty clay loam, dark yellowish brown (10YR 4/4) moist; weak medium and coarse prismatic structure; hard, firm, slightly sticky and slightly plastic; few fine exped roots; many very fine and fine and few medium tubular pores; common fine concretions; peds and pores have bleached sand and silt grains on ped faces; few moderately thick clay films on faces of peds; slightly acid (pH 6.3).

The solum is 45 to more than 60 inches thick.

In undisturbed pedons a very thin 0 horizon is present. The A1 horizon has value of 2 or 3 moist and 4 or 5 dry. The B2 horizon has value of 3 or 4 moist and 4 to 6 dry and chroma of 2 or 3. In some pedons, the B2 horizon has a few thin clay films. The A'2 horizon has value of 4 or 5 moist and 6 or 7 dry and chroma of 2 or 3. It is silt or silt loam. The B'2t horizon has hue of 10YR or 7.5YR and value of 4 or 5 moist and 5 or 6 dry. It is silt loam or silty clay loam.

Taney series

The Taney series consists of very deep, moderately well drained soils that formed in loess and a minor amount of volcanic ash. These soils are on loess hills. They have slopes of 3 to 25 percent. They have a perched water table during spring. The mean annual precipitation is about 25 inches, and mean annual air temperature is about 43 degrees F. Mean annual soil temperature is 44 to 46 degrees.

Taney soils are similar to the Larkin and Naff soils and are near the Benewah, Santa, and Southwick soils. Larkin and Naff soils have a mean annual soil temperature of more than 47 degrees. Benewah soils have a light brownish gray A horizon. Santa soils have a fragipan. Southwick soils have a mean annual soil temperature of more than 47 degrees.

Typical pedon of Taney silt loam, 3 to 7 percent slopes, about 5 miles west of Plummer, 100 feet south and 150 feet west of the northwest corner of SE1/4 sec. 18, T. 46 N., R. 5 W.:

Ap1-0 to 2 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak thin platy structure parting to weak fine granular; soft, very friable, slightly sticky and slightly plastic; many very fine, fine, and medium roots; many very fine and fine interstitial pores; medium acid (pH 6.0); abrupt smooth boundary; 2 to 3 inches thick.

Ap2-2 to 9 inches; brown (10YR 5/3) silt loam, dark brown (10YR 3/3) moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine and few medium roots; many fine tubular and interstitial pores; medium acid (pH 5.6); clear smooth boundary; 5 to 7 inches thick

A13-9 to 13 inches; brown (10YR 5/3) silt loam, dark brown (10YR 3/3) moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine and few medium roots; many fine and medium tubular and interstitial pores; medium acid (pH 5.8); clear smooth boundary; 4 to 5 inches thick

A14-13 to 18 inches; brown (10YR 5/3) silt loam, dark brown (10YR 3/3) moist; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine and few medium roots; many fine and medium tubular and interstitial pores; common black concretions; medium acid (pH 5.8); clear smooth boundary; 4 to 5 inches thick.

B2-18 to 25 inches; pale brown (10YR 6/3) silt loam, dark brown (10YR 3/3) moist; weak medium subangular blocky structure; hard, firm, slightly sticky and slightly plastic; common very fine and fine and few medium roots; many fine and medium tubular and interstitial pores; many fine black concretions; medium acid (pH 5.7); abrupt wavy boundary; 5 to 10 inches thick.

A'2-25 to 28 inches; light gray (10YR 7/2) silt, dark brown (10YR 4/3) moist; massive; hard, friable; few fine roots; few very fine and fine tubular pores; many fine black concretions; some material from the B't horizon in lower part; medium acid (pH 5.8); abrupt wavy boundary; 3 to 6 inches thick

B'21t-28 to 36 inches; light yellowish brown (10YR 6/4) silty clay loam, yellowish brown (10YR 5/4) moist; strong medium prismatic structure; extremely hard, very firm, very sticky and plastic; few fine flattened exped roots; many fine and medium tubular and interstitial pores; thin continuous clay films on faces of peds; many fine black concretions; few faint mottles on faces of peds; bleached silt coatings on faces of peds; strongly acid (pH 5.1); clear smooth boundary; 8 to 12 inches thick.

B'22t-36 to 45 inches; light yellowish brown (10YR 6/4) silt clay loam, yellowish brown (10YR 5/4) moist; moderate medium prismatic structure; extremely hard, very firm, very sticky and plastic; few fine flattened exped roots; many fine and medium tubular and interstitial pores; continuous moderately thick clay films on faces of peds; few faint mottles on faces of peds; many black stains; some silt coatings on faces of peds; strongly acid (pH 5.4); clear smooth boundary; 8 to 12 inches thick

B'23t-45 to 53 inches; pale brown (10YR 6/3) silty clay loam, yellowish brown (10YR 5/4) moist; weak medium and coarse prismatic structure parting to moderate medium subangular blocky; very hard, very firm, very sticky and plastic; many fine and medium pores; continuous moderately thick clay films on faces of pads; many black concretions; some black splotches; some bleached silt coatings on faces of pads; medium acid (pH 5.7); clear smooth boundary; 8 to 13 inches thick.

B'3t-53 to 60 inches; pale brown (10YR 6/3) silt loam, yellowish brown (10YR 5/4) moist; weak medium and coarse prismatic structure parting to moderate medium subangular blocky; hard, firm, sticky and plastic; many fine and medium pores; continuous thin clay films on faces of pads; many black concretions; some bleached silt coatings on faces of pads; medium acid (pH 6.0).

The solum is 45 to more than 60 inches thick.

In undisturbed pedons a thin 0 horizon is present- The A1 or Ap horizon has value of 4 or 5 dry and chroma of 2 or 3. The B2 horizon has value of 4 to 6 dry and chroma of 2 or 3. The A'2 horizon has value of 6 to 8 dry and 3 to 5 moist and chroma of 2 or 3. The B't horizon has value of 5 or 6 dry and 4 or 5 moist.

Tekoa series

The Tekoa series consists of moderately deep, well drained soils that formed in material derived from shale or sandstone with a mantle of loess and volcanic ash. These soils are on mountains. They have slopes of 5 to 65 percent. The mean annual precipitation is about 22 inches, nd mean annual air temperature is about 47 degrees F. Mean annual soil temperature is 47 to 50 degrees.

Tekoa soils are similar to the Bobbitt and Schumacher soils and are near the Ardenvoir, Huckleberry, McCrosket, and Southwick soils. Bobbitt soils have hard fractured basalt at a depth of 20 to 40 inches. Schumacher soils average less than 35 percent coarse fragments in the B horizon. Ardenvoir and McCrosket soils have fractured metasedimentary rock at a depth of 40 to 60 inches. Huckleberry soils have a yellowish brown silt loam A horizon. Southwick soils are very deep and do not have coarse fragments.

Typical pedon of Tekoa shaly silt loam, about 1,800 feet southwest of farmstead, 700 feet north and 760 feet west of center of sec. 19, T. 44 N., R. 5 W.:

A11-0 to 3 inches; dark grayish brown (10YR 4/2) shaly silt loam, very dark grayish brown (10YR 3/2) moist; weak thin platy structure parting to weak very fine granular; soft, very friable, slightly sticky and slightly plastic; common fine and medium roots; few very fine vesicular pores; 15 percent shale fragments; neutral (pH 7.0); clear smooth boundary; 3 to 6 inches thick

A12-3 to 11 inches; dark grayish brown (10YR 4/2) shaly silt loam, very dark grayish brown (10YR 3/2) moist; weak coarse subangular blocky structure parting to weak fine and medium granular; soft, very friable, slightly sticky and slightly plastic; common fine and medium roots; common very fine tubular pores; 20 percent shale fragments; neutral (pH 6.8); clear smooth boundary; 5 to 9 inches thick.

B21t-11 to 16 inches; brown (10YR 5/3) shaly silt loam, dark brown (10YR 3/3) moist; moderate coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and medium roots; many very fine and fine tubular pores; few thin clay films on faces of peds and in pores; 25 percent shale fragments; neutral (pH 6.8); gradual wavy boundary; 4 to 8 inches thick.

IIB22t-16 to 21 inches; yellowish brown (10YR 5/4) very shaly loam, dark yellowish brown (10YR 4/4) moist; weak coarse subangular blocky structure; slightly hard, firm, sticky and plastic; common very fine and fine tubular pores; few thin clay films on faces of peds and in pores; thin patchy bleached silt coatings on faces of peds; 45 percent shale fragments; neutral (pH 6.7); gradual wavy boundary; 4 to 7 inches thick

11B3-21 to 29 inches; yellowish brown (10YR 5/4) very shaly loam, dark yellowish brown (10YR 4/4) moist; weak medium subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; few fine and medium roots; common very fine and fine tubular pores; thin patchy bleached silt coatings on faces of pads; 50 percent shale fragments; neutral (pH 6.8); gradual wavy boundary; 4 to 10 inches thick

IICr-29 inches; weathered shale.

Depth to weathered shale or sandstone is 20 to 40 inches.

The Al horizon has hue of 10YR or 7.5YR, value of 4 or 5 dry and 2 or 3 moist, and chroma of 2 or 3. It is shaly silt loam or shaly loam. This horizon is 15 to 30 percent shale fragments. The B2t horizon has hue of 10YR or 7.5YR, value of 5 or 6 dry and 3 or 4 moist, and chroma of 3 or
4. It is shaly or very shaly silt loam or loam. This horizon is 20 to 55 percent shale fragments. The IIB22t horizon is very shaly loam and is 35 to 55 percent shale fragments.

Tensed series

The Tensed series consists of very deep, moderately well drained soils that formed in colluvium from metasedimentary rock with a mantle of loess. These soils are on dissected terraces. They have slopes of 3 to 35 percent. They have a perched water table at a depth of 24 to 30 inches from February to April. The mean annual precipitation is about 24 inches, and mean annual air temperature is about 47 degrees F. Mean annual soil temperature is 47 to 50 degrees.

Tensed soils are similar to the Southwick, Thatuna, and Tilma soils and are near the McCrosket, Pedee, Taney, and Worley soils. Southwick soils have a pale brown B2 horizon. Thatuna soils have an Al horizon that is 16 to 24 inches thick. Tilma soils have a silty clay B horizon. McCrosket soils are more than 35 percent rock fragments in the B horizon, and weathered bedrock is at a depth of 40 to 60 inches. Pedee soils have a very gravelly clay B horizon. Taney soils have a mean annual soil temperature of less than 47 degrees. Worley soils have a silty clay B horizon.

Typical pedon of Tensed silt loam, 3 to 25 percent slopes, about 2.5 miles east of Tensed, 2,500 feet south and 180 feet west of center of sec. 8, T. 44 N., R. 4 W.:

Ap-0 to 8 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate coarse subangular blocky structure; very hard, friable, slightly sticky and slightly plastic; many fine roots; common very fine and fine pores; about 5 percent fine gravel; medium acid (pH 5.6); abrupt wavy boundary; 8 to 11 inches thick.

B2-8 to 18 inches; brown (10YR 5/3) silt loam, dark brown (10YR 3/3) moist; moderate medium subangular blocky structure; very hard, friable, slightly sticky and slightly plastic; many fine roots; many very fine and fine tubular pores; many fine black concretions; about 5 percent fine gravel; slightly acid (pH 6.4); clear wavy boundary; 6 to 12 inches thick.

A'2-18 to 23 inches; light gray (10YR 7/2) silt loam, grayish brown (10Y R 5/2) moist; massive; slightly hard, friable; few very fine roots; common very fine and fine tubular pores; many black concretions; about 5 percent fine gravel; neutral (pH 6.6); abrupt wavy boundary; 4 to 6 inches thick

B'21t-23 to 34 inches; light yellowish brown (10YR 6/4) silty clay loam, dark yellowish brown (10YR 4/4) moist; weak coarse prismatic structure parting to moderate medium angular blocky; extremely hard, firm, sticky and plastic; few very fine exped roots; many fine and medium tubular pores; many thin continuous clay films on faces of pads; common black concretions; about 10 percent fine and medium gravel; stone line at a depth of 34 inches with 25 percent fine and medium gravel; neutral (pH 6.8); abrupt wavy boundary; 8 to 13 inches thick.

B'22t-34 to 40 inches; light yellowish brown (10YR 6/4) silty clay loam, dark yellowish brown (10YR 4/4) moist; weak coarse prismatic structure parting to moderate medium angular blocky; extremely hard, firm, sticky and plastic; few very fine exped roots; common fine and medium tubular pores; many thin continuous clay films on faces of pads; common black concretions; about 5 percent fine gravel; neutral (pH 6.8); abrupt wavy boundary; 5 to 8 inches thick

IIB'23t-40 to 60 inches; light yellowish brown (10YR 6/4) very gravelly clay loam, dark brown (7.5YR 4/4) moist; weak medium subangular blocky structure; extremely hard, firm, sticky and plastic; common fine and medium tubular pores; many thin continuous clay films on faces of pads; common concretions; 70 percent gravel and 5 percent cobbles; neutral (pH 6.8).

The solum is more than 40 inches thick

In undisturbed pedons an 0 horizon is present. The Ap horizon has value of 2 or 3 moist and chromes of 2 or 3 dry and moist. The B2 horizon has chroma of 3 or 4 moist. The B'2t horizon has hue of 10YR or 7.5YR and chroma of 3 or 4.

Thatuna series

The Thatuna series consists of very deep, moderately well drained soils that formed in deep loess. These soils are on loess hills. They have slopes of 7 to 40 percent. They have a perched water table at a depth of 36 to 48 inches from February to April. The mean annual precipitation is about 20 inches, and mean annual air temperature is about 47 degrees F. Mean annual soil temperature is 47 to 50 degrees.

Thatuna soils are similar to the Southwick, Tensed, and Tilma soils and are near the Garfield, Naff, Palouse, and Schumacher soils. Southwick soils have a pale brown B2 horizon. Tensed soils have an Ap or Al horizon that is 8 to 11 inches thick and a silty clay loam subsoil. Garfield and Tilma soils have a silty clay B2t horizon. Naff soils do not have an A2 horizon. Palouse soils do not have a B2t horizon. Schumacher soils have weathered metasedimentary rock at a depth of 20 to 40 inches.

Typical pedon of Thatuna silt loam, 7 to 25 percent slopes (fig. 11), along state line road, 1,220 feet north of the southwest corner of sec. 24, T. 44 N., R. 6 W.:

Ap-0 to 5 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; very weak thin platy structure parting to moderate fine and very fine granular; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; many very fine interstitial pores; neutral (pH 6.8); clear smooth boundary; 5 to 10 inches thick.

A12-5 to 12 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; moderate fine and very fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; many very fine interstitial and tubular pores; neutral (pH 6.6); clear smooth boundary; 6 to 8 inches thick.

A13-12 to 19 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; many very fine tubular pores; neutral (pH 6.6); clear smooth boundary; 5 to 8 inches thick.

B2-19 to 27 inches; brown (10YR 5/3) silt loam, dark brown (10YR 3/3) moist; moderate medium and fine subangular blocky structure; hard, friable; slightly sticky and slightly plastic; common fine roots; many very fine tubular pores; slightly acid (pH 6.5); abrupt smooth boundary; 7 to 10 inches thick.

A'21-27 to 30 inches; pale brown (10YR 6/3) silt loam, dark brown (10YR 3/3) moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; many very fine tubular pores; slightly acid (pH 6.5); abrupt smooth boundary; 3 to 4 inches thick.

A'22-30 to 37 inches; very pale brown (10YR 7/3) and pale brown (10YR 6/3) silt loam, brown (10YR 4/3) moist; some streaks of brown material similar to the B'2 horizon; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; common very fine tubular pores; many fine black concretions; slightly acid (pH 6.5); abrupt smooth boundary; 3 to 9 inches thick.

B'21t-37 to 45 inches; light yellowish brown (10YR 6/4) silt loam, dark brown (7.5YR 4/4) moist; weak medium and fine prismatic structure parting to weak medium subangular blocky; very hard, very firm, sticky and plastic; white speckling in interior of peds, mostly in upper inch; few fine roots; many very fine tubular pores; many fine black concretions; thick continuous dark yellowish brown (10YR 4/4) clay films on faces of peds; bleached light brownish gray (10YR 6/2) silt grains on faces of peds; slightly acid (pH 6.4); clear smooth boundary; 7 to 9 inches thick.

B'22t-45 to 56 inches; light yellowish brown (10YR 6/4) silty clay loam, dark brown (7.5YR 4/3) moist; weak medium prismatic structure; very hard, very firm, sticky and plastic; few fine roots; many very fine tubular pores; many fine black concretions; continuous moderately thick clay films on faces of peds; some light colored speckling in interior of peds; slightly acid (pH 6.5); clear smooth boundary; 9 to 13 inches thick.

B'23t-56 to 60 inches; yellowish brown (10YR 5/4) silt loam, dark brown (7.5YR 4/4) moist; moderate medium subangular blocky structure; very hard, firm, sticky and plastic; few fine roots; many very fine tubular pores; many fine black concretions; many moderately thick clay films on faces of peds: neutral (pH 6.7).

The mollic epipedon is 23 to 36 inches thick. It is slightly calcareous below a depth of 43 inches in some pedons. Depth to the B'2t horizon is 29 to 40 inches.

The Ap or Al horizon has value of 4 or 5 dry and 2 or 3 moist. The B2 horizon has value of 4 or 5 dry. The A'2 horizon has chroma of 2 or 3 moist and dry.

Tilma series

The Tilma series consists of very deep, moderately well drained soils that formed in loess. These soils are on loess hills. They have slopes of 7 to 25 percent. They have a perched water table at a depth of 18 to 30 inches from November to April. The mean annual precipitation is about 20 inches, and mean annual air temperature is about 48 degrees F. Mean annual soil temperature is 47 to 51 degrees.

Tilma soils are similar to the Tensed and Thatuna soils and are near the Garfield, Latahco, Naff, and Palouse soils. Tensed and Thatuna soils average less than 35 percent clay in the B2t horizon. Garfield soils have an Ap or Al horizon that is 5 to 8 inches thick and do not have an A2 horizon. Latahco soils are somewhat poorly drained. Naff soils do not have an A2 horizon and average less than 35 percent clay in the B horizon. Palouse soils do not have an A2 or B2t horizon.

Typical pedon of Tilma silt loam, 3 to 40 percent slopes, about 0.8 mile south of Moctileme Creek, 180 feet west and 650 feet south of the northeast corner of sec. 25, T 45 N., R. 6 W.:

Ap-0 to 8 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; 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 interstitial pores; few bleached silt grains; medium acid (pH 6.0); abrupt smooth boundary; 6 to 10 inches thick.

A12-8 to 14 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many fine and very fine roots; many very fine interstitial pores; slightly acid (pH 6.1); clear smooth boundary; 3 to 7 inches thick.

B2-14 to 20 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; hard, friable, sticky and plastic; many fine and very fine roots; many very fine and common fine tubular pores; some organic stains on faces of peds; many bleached silt grains; slightly acid (pH 6.2); abrupt smooth boundary; 6 to 10 inches thick.

A'21-20 to 23 inches; pale brown (10YR 6/3) silt loam, dark brown (10YR 4/3) moist; weak medium prismatic structure; hard, friable, slightly sticky and slightly plastic; many fine and very fine roots; many fine and common fine pores; ped interiors contain bleached sand and silt grains; few black hard concretions; slightly acid (pH 6.4); abrupt smooth boundary; 2 to 5 inches thick.

A'22-23 to 24 inches; light gray (10YR 7/2) silt loam, dark grayish brown (10YR 4,'2) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; many fine and very fine roots; few very fine tubular pores; few fine black concretions; slightly acid (pH 6.4); abrupt smooth boundary; 0.5 inch to 2 inches thick.

B'21t-24 to 30 inches; brown (7_5YR 5/3) silty clay, dark brown (7.5YR 4/3) moist; strong medium columnar structure parting to weak medium and coarse subangular blocky; extremely hard, extremely firm, very sticky and very plastic; few fine and very fine roots that penetrate peds: many very fine tubular pores; continuous moderately thick clay films on faces of peds; many small medium black and brown concretions; medium acid (pH 6.0); abrupt smooth boundary; 5 to 12 inches thick.

B'22t-30 to 34 inches; brown (10YR 5/3) silty clay, light yellowish brown (10YR 6/4) rubbed, brown (7.5YR 5/3) moist; moderate medium prismatic structure; very hard, very firm, very sticky and very plastic; few fine roots; common very fine tubular pores; continuous moderately thick clay films on faces of peds; many black and brown fine concretions; slightly acid (pH 6.1); abrupt smooth boundary; 4 to 7 inches thick.

B'23t-34 to 42 inches; brown (10YR 5/3) silty clay loam, dark brown (7.5YR 4/3) moist; strong medium subangular blocky structure; very hard, firm, sticky and plastic; few very fine roots; many very fine tubular pores; continuous moderately thick clay films on faces of peds; slightly acid (pH 6.1); abrupt smooth boundary; 6 to 10 inches thick.

B'3t-42 to 60 inches; light yellowish brown (10YR 6/4) silt loam, yellowish brown (10YR 5/4) moist; weak medium prismatic structure parting to strong medium and fine angular blocky; extremely hard, extremely firm and brittle, slightly sticky and slightly plastic; common very fine tubular pores; continuous moderately thick clay films in pores; many small black concretions and patchy black stains on peds; neutral (pH 6.8).

The Ap or Al horizon has value of 4 or 5 dry and 2 or :3 moist. The A'2 horizon has value of 4 or 5 moist. The B'2t horizon is silty clay or silty clay loam. The B'3t horizon is extremely firm or very firm and resembles a weakly developed fragipan in some pedons.

Worley series

The Worley series consists of very deep, moderately well drained soils that formed in deep loess. These soils are on loess hills. They have slopes of 10 to 25 percent. They have a perched water table at a depth of 18 to 24 inches from February to April. Mean annual precipitation is about 23 inches, and mean annual air temperature is about 48 degrees F. Mean annual soil temperature is 49 to 51 degrees.

Worley soils are similar to the Garfield and Pedee soils and are near the Cald, Larkin, Southwick, and Thatuna soils. Garfield soils have an Ap or Al horizon that is 5 to 8 inches thick. Pedee soils have a very gravelly clay B2t horizon. Cald soils are somewhat poorly drained. Larkin, Southwick, and Thatuna soils average less than 35 percent clay in the B2t horizon.

Typical pedon of Worley silt loam, 10 to 25 percent slopes (fig. 12), about 4 miles west of Plummer, 800 feet east and 400 feet north of the southwest corner of NW1/4 sec. 9, T. 46 N., R. 5 W.:

Ap-0 to 7 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak medium subangular blocky structure parting to moderate medium granular; slightly hard, friable, slightly sticky and slightly plastic; common fine roots; many very fine and few fine tubular pores; medium acid (pH 5.8); clear smooth boundary ; 7 to 9 inches thick.

A12-7 to 14 inches; dark grayish brown (10YR 4/2) silt loam, dark brown (10YR 3/3) moist; weak fine to very fine subangular blocky structure parting to weak medium granular; slightly hard, friable, sticky and slightly plastic; common fine roots; many very fine and few fine tubular pores; medium acid (pH 5.6); clear wavy boundary; 5 to 8 inches thick.

B2-14 to 19 inches; brown (10YR 513) silt loam, dark brown (10YR 3/3) moist; moderate very fine subangular blocky structure; slightly hard, friable, sticky and slightly plastic; common fine roots; many very fine and common fine tubular pores; medium acid (pH 5.7); abrupt wavy boundary; 4 to 6 inches thick.

A'2-19 to 20 inches; very pale brown (10YR 7/3) silt loam, brown (10YR 4/3) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; common fine roots; common very fine tubular pores; common fine black concretions; medium acid (pH 5.8); abrupt wavy boundary; 1 inch to 2 inches thick.

B'21t-20 to 40 inches; brown (7.5YR 5/4) silty clay, dark brown (7.5YR 4/4) moist; strong medium and coarse prismatic structure parting to moderate very fine angular blocky; extremely hard, extremely firm, sticky and very plastic; few fine roots; few very fine tubular pores; common fine black concretions: thin continuous clay films on faces of peds; medium acid (pH 5.8); clear wavy boundary; 15 to 20 inches thick.

B'22t-40 to 60 inches: light yellowish brown (10YR 6/4) silty clay loam, dark yellowish brown (10YR 4/4) moist; strong medium prismatic structure parting to strong medium angular blocky; extremely hard, extremely firm, very sticky and very plastic; few very fine pores: many thick continuous clay films on faces of peels; many fine black concretions; noncalcareous matrix with lime coatings on faces of peds; neutral (pH 7.2).

The umbric epipedon is 16 to 23 inches thick.

The A1 horizon has value of 4 or 5 dry and 2 or 3 moist and chroma of 2 or 3. The A'2 horizon has value of 6 or 7 dry. The B'2t horizon has value of 4 or 5 moist.

Formation of the soils

Soil is a natural body on the surface of the earth in which plants grow. It is a mixture of rocks, minerals, organic matter, water, and air; all of which occur in varying proportions. The rocks and minerals are fragmented and partly or entirely weathered. Soils have more or less distinctive layers, or horizons, that are the product of environmental forces acting upon material deposited or accumulated by geological processes.

The characteristics of the soil are determined by the interaction of parent material, climate, relief or topography, living organisms, and the length of time these forces have acted on the soil material.

Parent material

Parent material in which the soils in the Benewah County Area formed are residual, alluvial, and eolian.

The most extensive geologic units in the area are the Belt Series of Precambrian rocks. These metamorphosed rocks, siltite, argillite, and quartzite occur throughout the area. They are highly fractured rocks, and soils formed in materials derived from them mostly have a high percentage of coarse fragments. Huckleberry, McCrosket, Ardenvoir, and Tekoa soils are typical of this group. These soils also contain some loess blown from central Washington during the late Pleistocene. Ash from volcanoes in the Cascade mountains to the west was deposited during the Pleistocene and Holocene.

Basalt flows also occur throughout the survey area and form plateaus. In most places, the basalt is covered by thick deposits of loess. On terrace escarpments and foot slopes, the loess has been eroded away and the basalt is exposed. Lacy, Bobbitt, Blinn, and Dorb soils formed on these escarpments and have a high percentage of rock fragments mixed with thin surficial deposits of loess and volcanic ash.

Thick loess deposits also mantle the gentler slopes of pre-Tertiary rock-cored hills and ridges that were not later covered by basalt flows. The soils that formed in the loess deposits are very deep and have a silt loam surface layer and a silt loam to silty clay subsoil. Some soils that formed in loess, such as Southwick, Taney, Thatuna, and Santa soils, are relict paleosols. After the first accumulation of loess, soil forming processes acted for sufficient time to form soil horizons. These processes were interrupted by a second loess deposition. Soil forming processes acting upon the second loess deposit are forming soil horizons. Thus, some soils of the modern landscape are forming partly in the paleosol.

Alluvium in the survey area is generally of local origin; it is derived from materials on the adjacent uplands. Because of the wide variety of sedimentary, metamorphic, and igneous rocks on the uplands, the alluvium contains a wide variety of materials. Alluvium on fans and toe slopes generally has texture and other characteristics that are similar to those on the hills from which the sediment was eroded. For example, Cald soils formed in materials that eroded from the surrounding loess hills. Alluvium in the St. Joe River Valley has been deposited by streams that overflowed their channels. As water spread over the flood plain, sediment was deposited. Where floodwaters moved slowly, silt and fine sands were deposited. Soils, such as Miesen and Ramsdell soils, formed in alluvium with these textures. Pywell soils are muck deposited in former ponds and lakes on the flood plain.

Climate

Climate functions directly in the accumulation of parent material and in the differentiation of soil horizons in the Benewah County Area. Temperature and rainfall strongly influence the rate of weathering of rocks, the decomposition of minerals, the accumulation and decomposition of organic matter, the growth of plants, and the processes of leaching, eluviation, and illuviation. The climate in the survey area is generally subhumid. It has warm, dry summers and cold, wet winters. Areas in the mountains have cooler summers and colder winters than areas in the valleys.

Differences in annual rainfall and temperature generally are associated with changes in elevation. The most precipitation is in the higher mountains in the eastern part of the survey area. In places, the yearly average precipitation is 50 inches or more. Average annual rainfall in the St. Maries area is about 30 inches, but in the drier, western part of the survey area it is 20 to 25 inches. The western part is the warmest, where the average annual temperature is about 47 degrees F. The higher mountains in the eastern part are the coldest, where the average annual temperature is 38 to 42 degrees.

Organic matter content is highest in the soils on loess plains in the western part of the survey area. The climate is warmer and drier, and the native vegetation is predominantly grasses. Soils, such as Palouse and Thatuna soils, have a thick dark surface layer and are high in humus and exchangeable bases. Soils in the colder, wetter mountains support native vegetation dominated by conifers. Soils, such as Huckleberry and Ardenvoir soils, have a light colored surface layer, are low in organic matter, and are leached of bases. The soils that formed under grass are higher in the organic matter than the soils that formed under trees because the annual dieback of grass roots is incorporated into the soils, while the tree litter falls on the soil.

Relief

Relief of the survey area is determined mainly by geologic history. The area has three predominant physiographic units: the St. Joe and Clearwater Mountains, the Palouse hills, and the St. Joe River Valley. Relief influences the formation of the soils in the county through its effects on drainage, erosion, air drainage, and variation in exposure to sun and wind.

The mountains owe their relief largely to tectonic processes. They have subsequent long, winding ridges and relatively steep side slopes. Some ridgetops are broad and have slopes that range from 5 to 25 percent. Other ridgetops are narrower and have slopes of more than 25 percent. Because of the steep and very steep slopes, the soils mostly are well drained and somewhat excessively drained. Geologic erosion is active, and accelerated erosion follows logging, fires, or other disturbances. Consequently, many of the soils are only moderately deep. Examples of moderately deep, steep and very steep soils are Huckleberry, Blinn, and Tekoa soils. Variations in rainfall, produced largely by local relief, are pronounced over short distances. For example, annual rainfall ranges from 30 inches at St. Maries to more than 50 inches in the mountains about 8 miles away. Ardenvoir soils, at the high elevations with north-facing slopes, receive less direct sunlight, have colder soil temperatures, and retain moisture longer than McCrosket soils with south-facing slopes, which are warmer and dry out faster. Because of these differences, the plant cover on these two soils is different. McCrosket soils have a dark colored surface layer, and Ardenvoir soils have a light colored surface layer. Ardenvoir soils generally are more leached of exchangeable bases than McCrosket soils.

The St. Joe River flood plain is flat or has slopes of less than 2 percent. Because of the level topography, drainage is poor and drainage outlets are lacking. This causes a seasonal high or fluctuating water table. Soils, such as Miesen and DeVoignes soils, formed on this flood plain under water-tolerant plants. Because of their poor drainage, these soils have gleyed underlying horizons and have brown and yellowish red mottles, which indicate intense reduction of iron. The Chatcolet soils which formed in terraces above the flood plain are moderately well drained. They do not have mottles and a seasonal high water table.

Living organisms

Plants, worms, bacteria, and fungi begin to grow and die with the accumulation of parent material. Organic matter accumulates on and in the surface layer. This accumulation is important in horizon differentiation of the soils in the survey area.

Soils of the loessial plains in the western part of the county formed under grasses. The abundant fibrous roots of these grasses added considerable humus to these soils. Micro-organisms are very active in these soils. Their activity has influenced the mixing or organic matter, the structure, and the tilth in Palouse, Thatuna, Southwick, and Larkin soils.

The colder and more moist, mountainous soils support a dense canopy of coniferous trees. The soils formed under trees have a thick litter layer and a thin, light colored mineral surface layer. Ardenvoir, Divers, Nakarna, and Jacot soils are examples of such soils.

The poorly drained soils of the flood plains formed under water-tolerant grasses, sedges, and forbs. Examples of these soils are Miesen, Latahco, Cald, and Pokey soils. While they were forming, the drainage was poor, water was readily available, and native plants grew abundantly. Consequently, these soils contain a large amount of organic matter and are some of the darkest soils in the survey area.

Time

The degree of horizonation in soils depends in part upon the length of time the soil has been exposed to weathering. Soils with minimal horizonation are considered young; soils with strongly expressed horizons are old; and soils with moderately differentiated horizons are intermediate in age. Generally, young soils occur in recently accumulated parent material, and old soils are in parent material that has been in place for thousands of years.

Most soils on the flood plains are young. Miesen and Cald soils formed in unconsolidated sediment that was recently deposited. These soils have an accumulation of organic matter that formed in Al horizon and are generally leached of bases.

Setters, Tensed, and Worley soils are on old dissected plains. These soils are considered the oldest soils in the county because they have the most strongly differentiated horizons. They have had sufficient time for the translocation of silicate clay minerals. They have an abrupt textural change between the A horizon and the B2t horizon.

Soils in the mountains and on the foothills vary in the degree of horizonation. Young soils, such as Brickel soils, have steep and very steep slopes. They are moderately deep over bedrock and have a thin A horizon. These soils are young because they lose soil material by geologic erosion almost as fast as it forms. McCrosket soils, although young, are less susceptible to erosion. They have had sufficient time for the accumulation of more organic matter in the surface layer and for some chemical alternation of primary minerals. Benewah, Rasser, Schumacher, and Tekoa soils are intermediate in age. They have had time for some translocation of silicate clay minerals as indicated by changes in color, texture, structure, and consistence of the B2t horizon.

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Glossary

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.

Area reclaim. An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

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	More than 9

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.

Bottom land. The normal flood plain of a stream, subject to frequent flooding.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Calcareous soil. A soil containing enough calcium carbonate (commonly with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid. A soil having measurable amounts of calcium carbonate or magnesium carbonate.

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 fragment.

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 coat, clay skin.

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.

Coarse fragments. Mineral or rock particles up to 3 inches (2 millimeters to 7.5 centimeters) in diameter.

Coarse textured (light textured) soil. Sand or loamy sand.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.5 to 25 centimeters) in diameter.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the bases of steep slopes.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures is difficult.

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.

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.-When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.-When wet, 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 40 or 80 inches (1 or 2 meters).

Cutbanks cave. Unstable walls of cuts made by earthmoving equipment. The soil sloughs easily.

Deferred grazing. A delay in grazing until range plants have reached a specified stage of growth. Grazing is deferred in order to increase the vigor of forage and to allow desirable plants to produce seed. Contrasts with continuous grazing and rotation grazing.

Depth to rock. Bedrock at a depth that adversely affects the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

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.-Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.-Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.-Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.-Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically for long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.-Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.-Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained_ The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.-Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients, as for example in "hillpeats" and "climatic moors."

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.

Erosion. The wearing away of the land surface by running 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 a bare surface.

Excess fines. Excess silt and clay. The soil does not provide a source of gravel or sand for construction purposes.

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grains are grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

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.

Fine textured (heavy textured) soil. Sandy clay, silty clay, and clay.

Flagstone. A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist, 6 to 15 inches (15 to 37.5 centimeters) long.

Flooding. The temporary covering of soil with water from overflowing streams, runoff from adjacent slopes, and tides. Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *occasional* that it occurs on an average of once or less in 2 years; and. *frequent* that it occurs on an average of more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; *November-May,* for example, means that flooding can occur during the period November through May. Water standing for short periods after rainfall or commonly covering swamps and marshes is not considered flooding.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

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. Freezing and thawing of soil moisture. Frost action can damage structures and plant roots.

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.

Gleyed soil. A soil having one or more neutral gray horizons as a result of waterlogging and lack of oxygen. The term "gleyed" also designates gray horizons and horizons having yellow and *gray* mottles as a result of intermittent waterlogging.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.5 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material from 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.5 centimeters) in diameter.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table, which is the upper limit of saturation.

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.

Hemic soil material (mucky peat). Organic soil material intermediate in degree of decomposition between the less decomposed fibric and the more decomposed sapric material.

Horizon, soil. A layer of soil, approximately parallel to the surface, hav-ing distinct characteristics produced by soil-forming processes. The major horizons of mineral soil are as follows:

O horizon.-An organic layer, fresh and decaying plant residue, at the surface of a mineral soil.

A horizon.-The mineral horizon, formed or forming 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.

A2 horizon.-A mineral horizon, mainly a residual concentration of sand and silt high in content of resistant minerals as a result of the loss of silicate clay, iron, aluminum, or a combination of these.

B horizon.-The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or a combination of these; (2) by prismatic or blocky structure; (3) by redder or browner colors than those in the A horizon; *or (4) by* a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C *horizon.*-The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that from which the solum is presumed to have formed. If the material is known to differ from that in the solum the Roman numeral II precedes the letter C.

R layer.-Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Hummocky. Refers to a landscape of hillocks, separated by low sags, having sharply rounded tops and steep sides. Hummocky relief resembles rolling or undulating relief, but the tops of ridges are narrower and the sides are shorter and less even.

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.

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 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.

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.

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.

Lacustrine deposit (geology). Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Large stones. Rock fragments 10 inches (25 centimeters) or more across. Large stones adversely affect the specified use.

Leaching. The removal of soluble material from soil or other material by percolating water.

Light textured soil. Sand and loamy sand.

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 strength. Inadequate strength for supporting loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is greater than that of organic soil.

Moderately coarse textured (moderately light textured) soil. Sandy loam and fine sandy loam.

Moderately fine textured (moderately heavy textured) soil. Clay loam, sandy clay loam, and silty clay loam.

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 con*trast-faint, distinct,* and *prominent.* The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about *02* inch); *medium,* from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse,* more than 15 millimeters (about 0.6 inch).

Munsell notation. A designation of color by degrees of the three single variables-hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Pan. A compact, dense layer in a soil. A pan impedes the movement of water and the growth of roots. The word "pan" is commonly combined with other words that more explicitly indicate the nature of the layer; for example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan.*

Parent material. The great variety of unconsolidated organic and mineral material in which soil forms. Consolidated bedrock is not yet parent material by this concept.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

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. The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality that enables the soil to transmit water or air, measured as the number of inches per hour that water moves through the soil. Terms describing permeability are *very slow* (less than 0.06 inch), *slow (0.06* to 020 inch), *moderately slow (02* to 0.6 inch), *moderate* (0.6 to 2.0 inches), *moderately rapid (2.0* to 6.0 inches), *rapid* (6.0 to 20 inches), and *very rapid* (more than *20* inches).

Piping. Moving water of subsurface tunnels or pipelike cavities in the soil.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Polypedon. A volume of soil having properties within the limits of a soil series, the lowest and most homogeneous category of soil taxonomy. A "soil individual."

Poor outlets. Surface or subsurface drainage outlets difficult or expensive to install.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Range (or rangeland). Land that, for the most part, produces native plants suitable for grazing by livestock; includes land supporting some forest trees.

Reaction, soil. The degree 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
Medium 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

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered, or partly weathered mineral material that accumulates over disintegrating rock.

Rill. A steep sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rock fragments. Rock or mineral fragments having a diameter of *2* millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth. Shallow root zone. The soil is shallow over a layer that greatly restricts roots. See Root zone.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged in stream channels from a drainage area. The water that flows off the land surface without sinking in is called surface runoff; that which enters the ground before reaching surface streams is called ground-water runoff or seepage flow from ground water.

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.

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.

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 winddeposited sand is consolidated into sandstone.

Seepage. The rapid movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils, formed from a particular type of parent material, having horizons that, except for the texture of the A or surface horizon, are similar in all profile characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineralogical and chemical composition.

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. 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.

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.

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 feet.

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.

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.

Slow intake. The slow movement of water into the soil.

Slow refill. The slow filling of ponds, resulting from restricted permeability in the soil

Small stones. Rock fragments 3 to 10 inches (7.5 to 25 centimeters) in diameter. Small stones adversely affect the specified use.

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: *very coarse sand* (2.0 millimeters to 1.0 millimeter); *coarse sand (1.0* to 0.5 millimeter); *medium sand* (0.5 to 025 millimeter); *fine sand* (025 to 0.10 millimeter); *very fine sand (0.10* to 0.05 millimeter); *silt* (0.005 to 0.002 millimeter); and *clay* (less than 0.002 millimeter).

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in mature soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristics of the soil are largely confined to the solum.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stratified. Arranged in strata, or layers. The term refers to geologic material. Layers in soils that result from the processes of soil formation are called horizons; those inherited from the parent material are called strata.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates that are separated from adjoining 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 grained* (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, to provide protection from soil blowing 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.

Substratum. The part of the soil below the solum.

Subsurface layer. Technically, the A2 horizon Generally refers to a leached horizon lighter in color and lower in content of organic matter than the overlying surface layer.

Surface soil. 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."

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 or management.

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 it can soak into the soil or flow slowly to a prepared outlet without harm. A terrace in a field is generally 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. A stream terrace is frequently called a second bottom, in contrast with a flood plain, and is seldom subject to overflow. A marine terrace, generally wide, was deposited by 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,* silt *loam, 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. Otherwise suitable soil material too thin for the specified use.

Tilth, soil. The condition of the soil, especially the soil structure, as related to the growth of plants. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Topsoil (engineering). Presumably a fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

Valley fill. In glaciated regions, material deposited in stream valleys by glacial melt water. In nonglaciated regions, alluvium deposited by heavily loaded streams emerging from hills or mountains and spreading sediments onto the lowland as a series of adjacent alluvial fans.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but the limited geographic soil area does not justify creation of a new series.

Variegation. Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage.

Water table. The upper limit of the soil or underlying rock material that is wholly saturated with water.

Water table, apparent. A thick zone of free water in the soil. An apparent water table is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil.

Water table, artesian. A water table under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole. *Water table, perched.* A water table standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Illustrations

Figure 1.-Area of Southwick-Larldn map unit on undulating, loess-covered plains in the northwestern part of Benewah County.

Figure 2.-Area of Taney map unit used for the production of bluegrass seed. This kind of crop helps prevent erosion.

Figure 3.-Area of Santa map unit used for the production of wheat. Conservation management is needed on these soils to maintain fertility and prevent erosion.

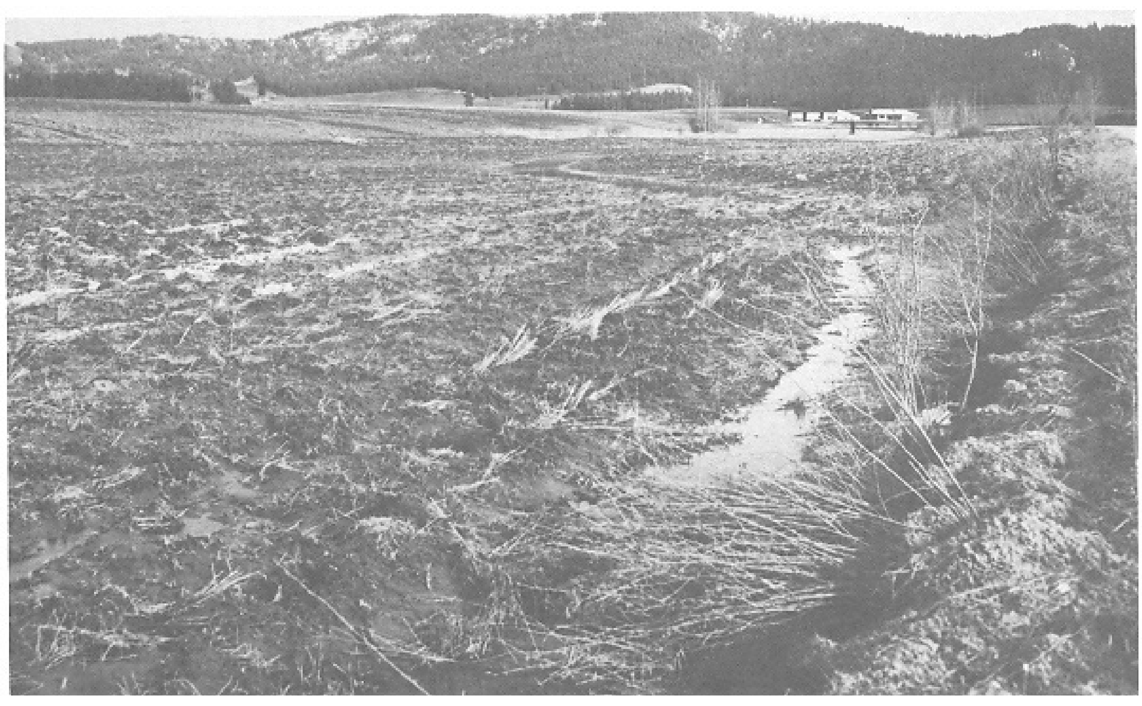

Figure 4.-A wet area of Cald-Thatuna silt loams, 0 to 7 percent slopes. Unless drainage is provided, wetness limits the choice of crops on these soils.

Figure 5.-Floodine in an area of Latahco-Lovell silt loams, 0 to 2 percent slopes, along Hangman Creek near Tensed.

Figure 6.-Gradient terraces on Southwick silt loam, 3 to 12 percent slopes,help reduce erosion.

Figure 7.-Swathing in a field of excellent hay on Taney silt loam, 7 to 25 percent slopes, near Plummer.

Figure 8.-A bumper crop of wheat on Taney silt loam, 3 to 7 percent slopes.

Figure 9.-Improved pasture on Schumacher silt loam, 7 to 25 percent slopes. Grasses are Idaho fescue, bluebunch wheatgrass, and Sandberg bluegrass.

Figure 10.-A good cover of grass for grazing in an open stand of ponderosa pine on Lacy-Bobbitt stony loams, 5 to 35 percent slopes.

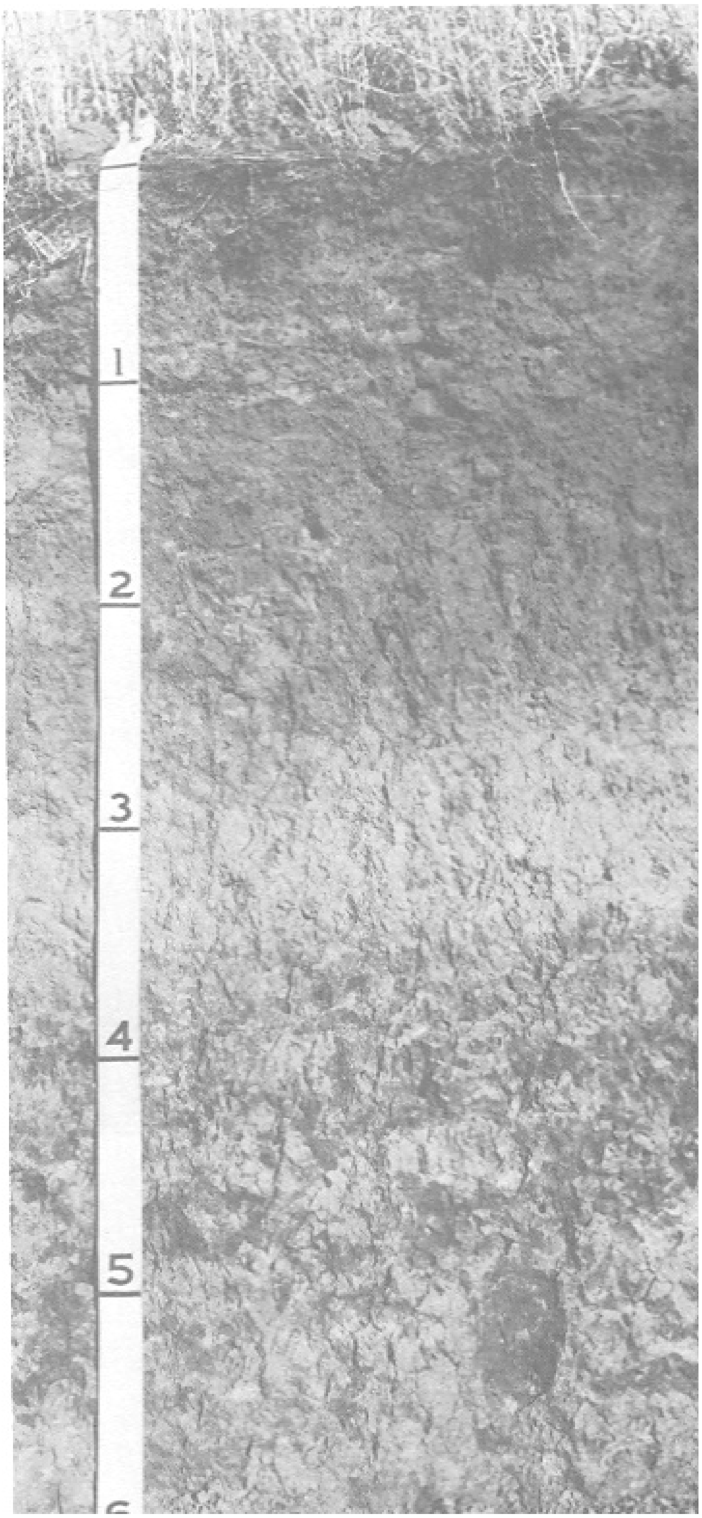

Figure 11.-Profile of Thatuna silt loam, 7 to 25 percent slopes.

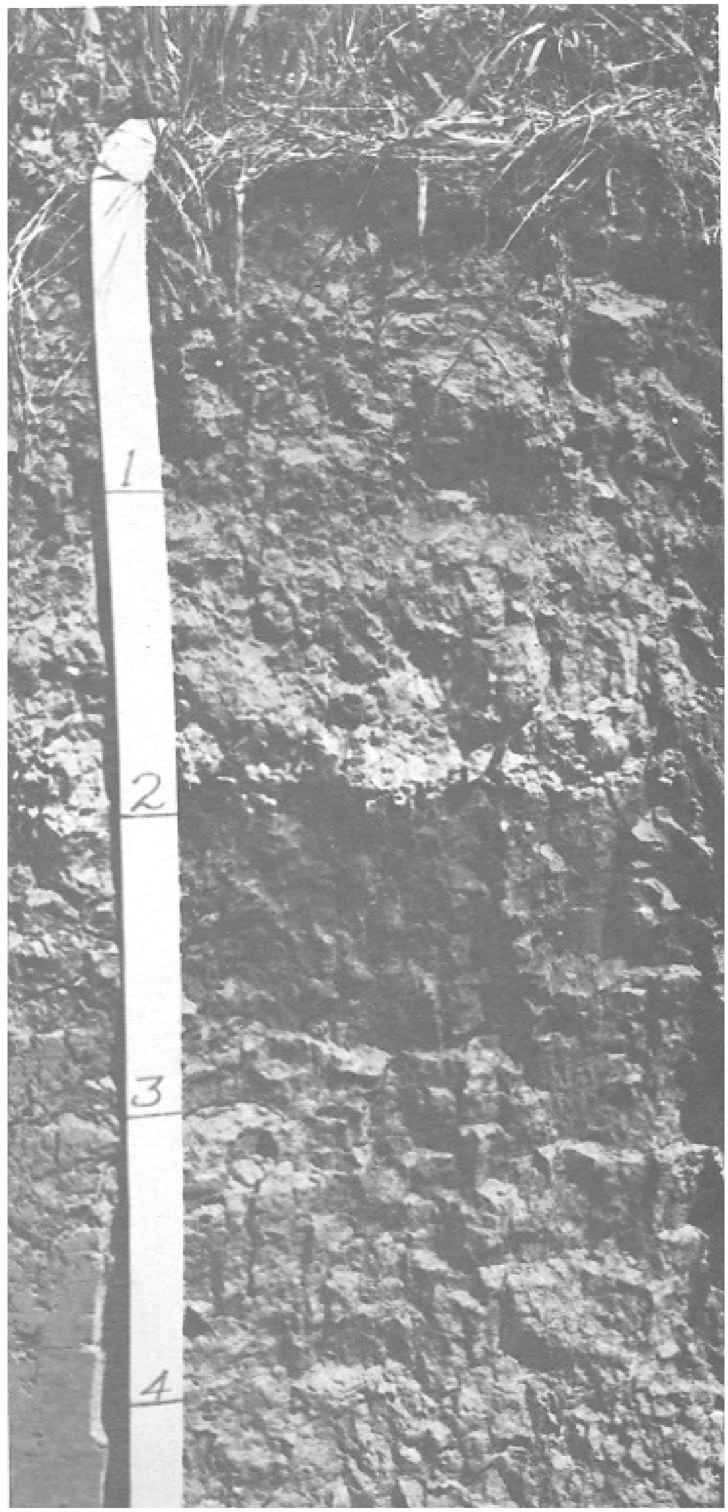

Figure 12.-Profile of Worley silt loam, 10 to 25 percent slopes.