United States Department of Agriculture,
Forest Service and
Natural Resources Conservation Service

In cooperation with the
Montana Agricultural Experiment Station

Soil Survey of Kootenai National Forest Area, Montana and Idaho

How To Use This Soil Survey

General Soil Map

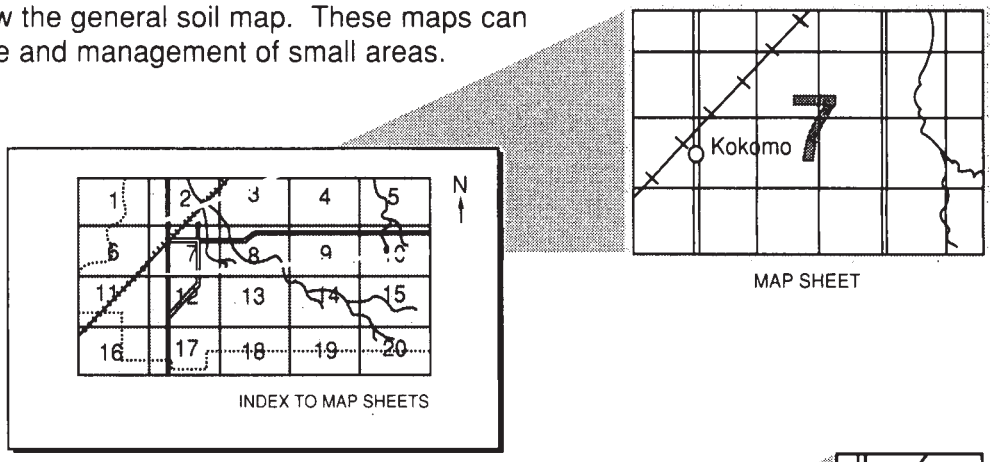
The general soil map, which is the color map preceding the detailed soil maps, shows the survey area divided into groups of associated soils called general soil map units. This map is useful in planning the use and management of large areas.

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

Detailed Soil Maps

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

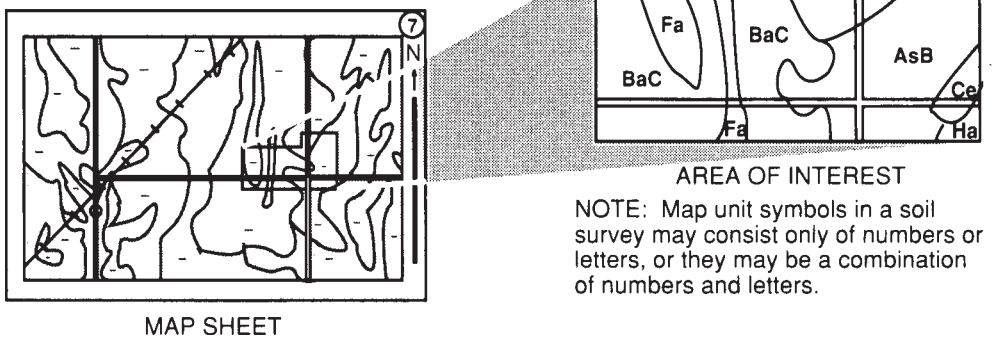
To find information about your area of interest, locate that area on the **Index to Map Sheets**, which precedes the soil maps. Note the number of the map sheet, and turn to that sheet.



INDEX TO MAP SHEETS

MAP SHEET

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



MAP SHEET

AREA OF INTEREST

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

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

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The fieldwork and technical quality control for this survey were conducted by the Forest Service. The correlation of the soils was conducted by the Natural Resources Conservation Service (formerly the Soil Conservation Service) in consultation with the Forest Service. The Natural Resources Conservation Service has leadership for the Federal part of the National Cooperative Soil Survey.

Fieldwork for this soil survey was performed in the period 1971-82. Soil names and descriptions were approved in 1988. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1988. This survey was made by the Forest Service and the Natural Resources Conservation Service in cooperation with the Montana Agricultural Experiment Station.

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

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

Cover: A view of the Libby Valley and Kootenai River. The Cabinet Mountain Range is in the background.

Contents

Index to map units iv
Summary of tables vi
Preface vii
General nature of the survey area 1
History and development 1
Natural resources 2
Climate 2
Physiography 2
Geology 6
Vegetation 7
How this survey was made 8
General soil map units 11
Detailed soil map units 15
Use and management of the soils 65
Timber 65
Roads 66
Watershed 68
Wildlife and fisheries 69
Recreation and visual quality 70
Wildfire 70
Minerals 70
Range 70
Wilderness 71
Classification of the soils 73
Andepts 74
Vitrandepts 74
Aquolls 75
Calciaquolls 75
Boralfs 76
Eutroboralfs 76
Glossoboralfs 77
Fluvents 78
Fluvents 78
Udifluvents 79
Ochrepts 79
Cryochrepts 79
Dystrochrepts 81
Eutrochrepts 82
Ustochrepts 85
Xerochrepts 86
Xerolls 88
Calcixerolls 88
Formation of the soils 91
References 93
Glossary 95
Tables 103

Issued September 1995

Index to Map Units

101—Fluvents, flood plains 15
102—Andic Dystric Eutrochrepts, lacustrine terraces 16
103—Andic Dystrochrepts, alluvial terraces 17
104—Andic Dystrochrepts-Umbric Vitrandepts complex, kames and kettles 18
105—Aquic Udifluvents, poorly drained 20
106—Andic Dystrochrepts, glacial outwash terraces 20
107—Typic Xerochrepts, glacial outwash terraces 21
108—Andic Dystric Eutrochrepts, lacustrine terraces-Andic Dystrochrepts, glacial outwash terraces, complex 22
109—Typic Xerochrepts, alluvial terraces 23
110—Eutrochrepts, glacial outwash terraces 24
111—Calcixerollic Xerochrepts, glacial outwash terraces 25
112—Eutric Glossoboralfs, lacustrine terraces 26
114—Typic Xerochrepts, lacustrine terraces 27
201—Rock outcrop-Lithic Ustochrepts-Typic Ustochrepts complex, breaklands 27
251—Andic Dystrochrepts-Rock outcrop complex, breaklands 28
252—Andic Dystrochrepts, breaklands 29
301—Dystric Eutrochrepts, glaciated mountain slopes 30
302—Typic Ustochrepts, glaciated mountain slopes, steep 31
303—Rock outcrop-Lithic Ustochrepts complex, glaciated mountain ridges 32
321—Typic Eutroboralfs, drumlins 33
322—Eutric Glossoboralfs, moraines 34
323—Typic Eutroboralfs, moraines 35
324—Typic Eutrochrepts, moraines 36
325—Aeric Calciaquolls, somewhat poorly drained 37
328—Andic Cryochrepts, glaciated mountain slopes 38
329—Andic Cryochrepts, moraines, dense, brittle substratum 39
351—Andic Dystrochrepts, dissected glaciated mountain slopes 40
352—Andic Dystrochrepts, glaciated mountain slopes 41
353—Andic Cryochrepts-Rock outcrop-Lithic Cryochrepts complex, glaciated mountain ridges 42
355—Andic Dystrochrepts-Rock outcrop complex, glaciated mountain slopes 43
357—Andic Cryochrepts-Lithic Cryochrepts complex, dissected glaciated mountain slopes 44
360—Rock outcrop-Lithic Cryochrepts complex, glaciated mountain ridges 45
365—Andic Dystrochrepts, dissected glaciated mountain slopes, steep 46
370—Andic Dystrochrepts, glaciated mountain slopes, granitic substratum 47
381—Typic Ustochrepts-Lithic Ustochrepts complex, dissected glaciated mountain slopes, dry 48
401—Rock outcrop-Andic Cryochrepts-Lithic Cryochrepts complex, glacial trough walls 50
403—Rock outcrop-Lithic Cryochrepts-Andic Cryochrepts complex, cirque headwalls and alpine ridges 51
404—Andic Cryochrepts, moraines, steep 52
405—Lithic Cryochrepts-Andic Cryochrepts-Rock outcrop complex, glaciated mountain ridges 53
406—Andic Cryochrepts, glaciated mountain ridges 54
407—Andic Cryochrepts, moraines 55
408—Andic Cryochrepts-Rock outcrop complex, glaciated mountain slopes, very steep 56
502—Typic Ustochrepts, mountain slopes, south aspects 57

503—Rock outcrop-Lithic Ustochrepts complex, south aspects 58
510—Typic Calcixerolls, south aspects 59
520—Andic Dystric Eutrochrepts, micaceous substratum 59
522—Andic Dystrochrepts, granitic substratum 60
552—Andic Dystrochrepts, mountain slopes 61
555—Andic Cryochrepts-Rock outcrop complex, mountain slopes 62
570—Andic Dystrochrepts-Typic Ustochrepts complex, mountain slopes 63

Summary of Tables

Average annual precipitation and temperature (table 1) 104

Features used to plot boundaries of map units (table 2) 105

Numerical listing of map symbols and the acreage of the soils (table 3) 108

Alphabetical listing of detailed soil map units (table 4) 110

Timber management and productivity (table 5) 111

Engineering index properties (table 6) 113

Road construction and maintenance (table 7) 116

Soil erosion and sedimentation (table 8) 118

Classification of the soils (grouped by suborder) (table 9) 120

Classification of the soils in the detailed soil map units (table 10) 121

Preface

This soil survey contains information that can be used in land-planning programs in the survey area. The landforms, natural vegetation, and bedrock were studied to a greater extent than usual in soil surveys in order to define and interpret map units. Surveys such as this one have been referred to in Forest Service publications as "land system inventories" or "integrated inventories." The map units have been called "landtypes."

This survey is designed primarily for use by Forest Service personnel managing Kootenai National Forest. Others who are interested in management of Kootenai National Forest can use this information to more effectively participate in decisions affecting the environment of the forest. Managers of privately owned forest land included in the survey area can use the survey to evaluate the potential for and limitations to production of wood products. Help in using this publication and additional information are available at the forest supervisor's office in Kootenai National Forest.

This survey area includes some privately owned urban and agricultural lands. This survey was not designed to provide information to be used in planning these land uses. Additional information can be obtained from the local office of the Natural Resources Conservation Service.

Soil Survey of Kootenai National Forest Area, Montana and Idaho

By Louis J. Kuennen and Marci L. Nielsen-Gerhardt

Fieldwork by Louis J. Kuennen, Marci L. Nielsen-Gerhardt, Terry Svalberg, and Jeff Collins; David J. Marrett and Steven G. VanFossen, Lake Creek valley; and Jack Cloninger, Tobacco River valley

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The survey area is mostly in the extreme northwestern part of Montana but includes a small part of northern Idaho (fig. 1). It includes all of Kootenai National Forest and the eastern part of Kaniksu National Forest, which is administered by personnel from Kootenai National Forest. It also includes private land, which is intricately mixed with the land in the national forests. The total area of this survey is 2,975,597 acres. The survey area consists of forested mountains with relatively narrow valleys along the major streams. The Clark Fork and Kootenai Rivers are the principal drainageways. They are part of the Columbia River basin. The survey area contains hundreds of large and small lakes and several large reservoirs.

National forests are managed for recreation, wildlife habitat, timber production, watershed, and livestock grazing. Most national forest land is open for mineral exploration and development. The included areas of privately owned land are mostly forested and are managed for many of the same uses as the land in the national forests.

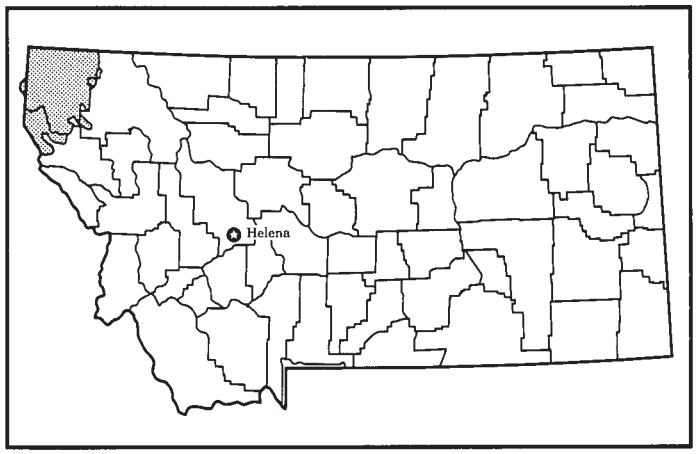

Figure 1.—Location of the Kootenai National Forest area.

General Nature of the Survey Area

This section provides general information about the survey area. It describes history and development, natural resources, climate, physiography, geology, and vegetation.

History and Development

While the Salish, Blackfeet, and Pend d'Oreille Tribes hunted and gathered food in the survey area prior to European settlement, this area was primarily used by the Kootenai Tribe. In 1808, David Thompson charted the Kootenai River for the Northwest Fur Company. Several trading posts were established in the valley by the Northwest Fur Company. The first one was in an area above Kootenai Falls, and a later one was at the mouth of the Fisher River. A fur collection depot was

later built by the Hudson Bay Company near the present location of Libby, which was established in the 1860's as a mining camp.

As a result of the Fort Laramie Treaty of 1868, the Blackfeet Tribe moved to Browning. The Kootenai Tribe moved to the Bonners Ferry and Flathead Lake areas as a result of the Hellgate Treaty of 1869. The Pend d'Oreille Tribe moved to the Spokane and Flathead Lake areas, and the Salish Tribe moved to the Flathead Lake area. European settlement began in earnest with the discovery of gold and silver in the 1880's. The Northern Pacific Railroad extended into the Clark Fork River valley in 1883, and the Great Northern Railroad extended into the Kootenai River valley in 1893. Mining communities were established along the railroads at Troy, Leonia, Noxon, Heron, and Trout Creek. Forests in the survey area provided a source of wood for railroad ties and mine timbers during this period. Lumber mills were constructed in most communities in the early 20th century.

Much of the acreage along the Kootenai River and the lower part of the Clark Fork River was set aside as forest reserves by the Federal government in 1897 and 1898. These reserves were incorporated into the Kootenai, Blackfeet, and Kaniksu National Forests in 1906 and 1907. The Blackfeet National Forest was later incorporated into the adjacent national forests.

Natural Resources

About 125 million board feet of timber is cut annually from Douglas-fir, Engelmann spruce, western larch, lodgepole pine, western white pine, grand fir, ponderosa pine, western hemlock, and western redcedar trees. Dimensional lumber is the major product. Small quantities of posts, poles, and house logs also are produced.

The area provides habitat for more than 350 wildlife species. Elk, moose, whitetail deer, mule deer, bighorn sheep, mountain goat, black bear, grizzly bear, mountain lion, and a variety of small mammals and birds inhabit the survey area. Streams, reservoirs, and lakes provide habitat for rainbow, cutthroat, lake, and brook trout; mountain whitefish; kokanee salmon; and smallmouth and largemouth bass.

The watersheds in the survey area are part of the Columbia River system. The water produced is used for recreation, fisheries, irrigation, and power generation. Water quantity is adequate for current uses, and water quality has historically been excellent.

Recreational opportunities include hunting, fishing, camping, hiking, cross-country skiing, rock climbing, berry picking, and river rafting.

Cattle graze grassland on the mountains along the Tobacco River valley and on transitory ranges created by logging or forest fires.

Silver and copper are actively mined in the survey area. Additional large deposits of ore are in the area but have not yet been mined.

Climate

The climate of the survey area is strongly influenced by Pacific maritime weather systems. Winters are generally cloudy, cool, and wet. November, December, and January generally are the wettest months. Most of the snowpack at the higher elevations accumulates in the period December to April. If rain falls on the snowpack during winter, flooding can occur. This flooding causes more damage than the flooding that can occur after spring snowmelt. It also causes some of the most severe damage.

In summer, days are warm and dry and nights are cool. Occasional late afternoon thunderstorms occur on hot summer days.

Table 1 gives the average annual precipitation and temperature for nine weather stations in the survey area *(6)*. The average annual precipitation shows a distinct difference between the western and eastern parts of the survey area. This difference is generally caused by the Cabinet and Bitterroot Ranges. Eureka, Fortine, and Rexford receive lower amounts of precipitation because they are in the eastern part of the survey area, and Trout Creek and Troy receive higher amounts because they are in the western part. The annual precipitation at the higher elevations in the mountains in the western part of the survey area is estimated to exceed 100 inches.

Climatic conditions in mountainous areas are extremely variable over short distances because of local topographic effects. "Frost pockets" are an example of a local topographic effect. Cold air is trapped in low areas on summer nights causing frequent summer frosts. Temperature inversions also are common in the valleys during winter. They occur when cold air is trapped in the valleys by warmer air that is at the higher elevations. They can cause fog and trap pollutants in the valleys.

Physiography

The survey area lies within the Northern Rocky Mountain physiographic province. It includes five mountain ranges and the intervening narrow valleys (fig. 2). The mountain ranges are the Whitefish, Purcell, Salish, Cabinet, and Bitterroot Ranges. The survey area is drained by two major rivers—the Kootenai and Clark Fork Rivers. The Tobacco, Fisher, and Yaak Rivers are

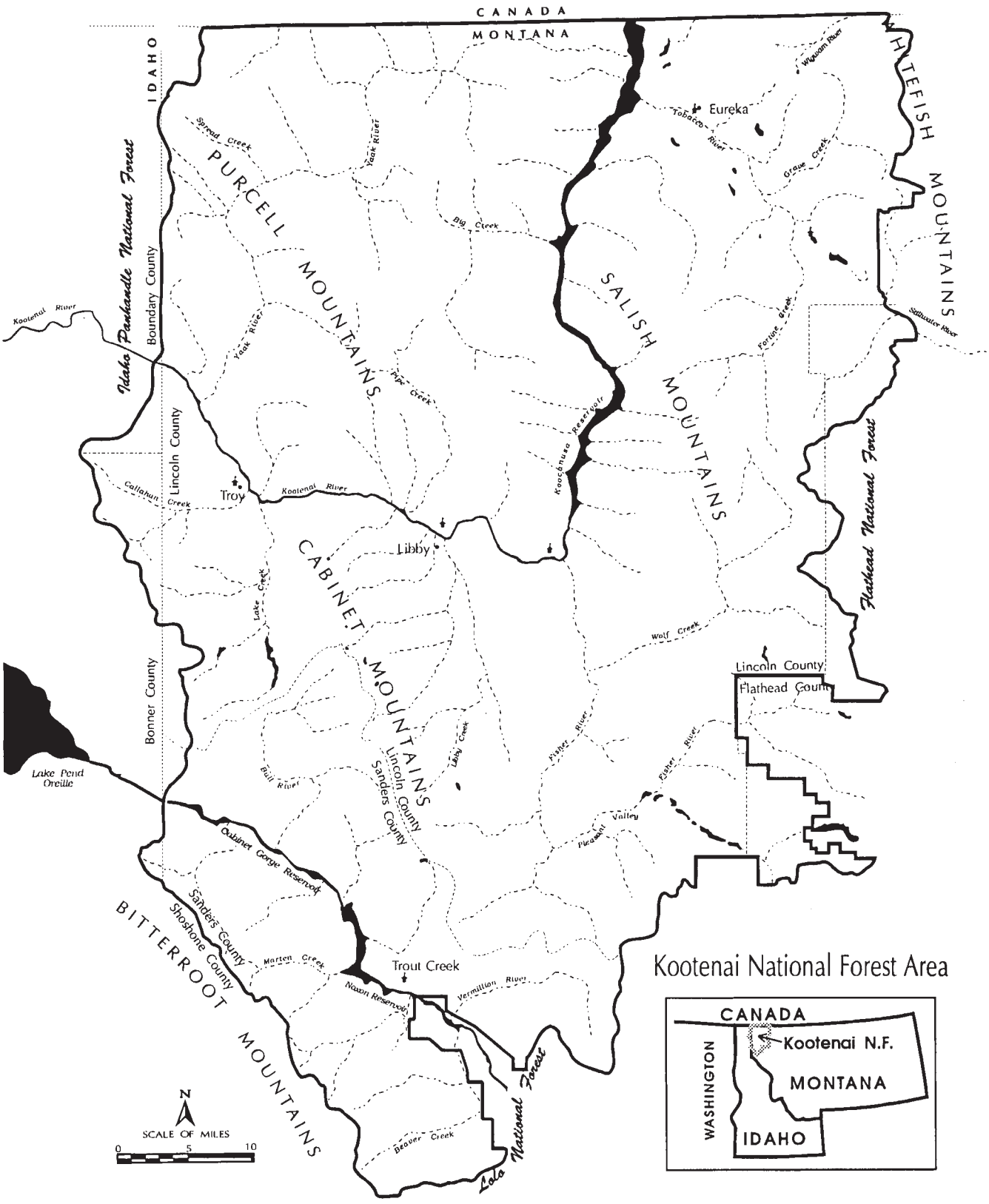

Figure 2.—Physiographic features of the survey area.

the major tributaries to the Kootenai River, and the Vermilion and Bull Rivers are the major tributaries to the Clark Fork River.

Approximately 70 percent of the survey area has been glaciated by continental ice sheets. Continental ice sheets advanced several times during the Pleistocene epoch. The last one retreated about 10,000 years ago. Glacial lakes filled many of the valleys at times during glacial advance and retreat. Lake Missoula is an example of a glacial lake formed during glacial advance, and Lake Kootenai is an example of one formed during glacial retreat. The higher mountains that were not overridden by the continental ice sheets were subjected to intense alpine glaciation.

Most landforms in the survey area have been influenced by glaciation. Glacial cirques, U-shaped glacial valleys, moraines, and terraces are examples of landforms that formed in glacial lake sediments or outwash.

Each detailed soil map unit in this survey is on a characteristic landform. General soil map units are on a combination of landforms. Landform properties visible on aerial photography were often used to plot the boundaries of the map units. The landform properties of the map units can help map users identify map unit delineations.

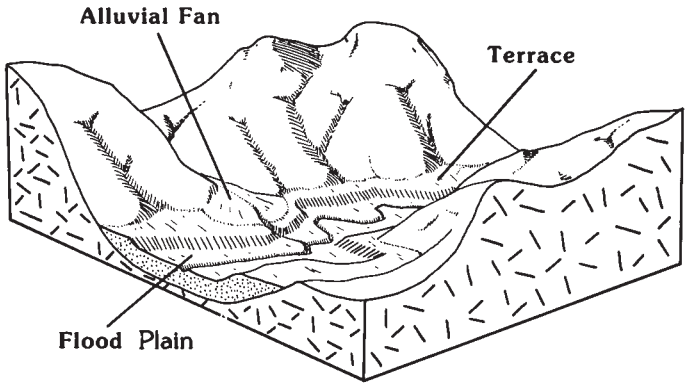

Figure 3.—A flood plain, terrace, and alluvial fan in a narrow mountain valley. Large terraces are mapped as separate landforms.

The following classes of landforms were used to define map units and assist in mapping.

Flood plains contain a major perennial stream (fig. 3). They are produced by stream channel migration and flooding. They are gently sloping. Soils on flood plains can have a water table and are usually subject to flooding.

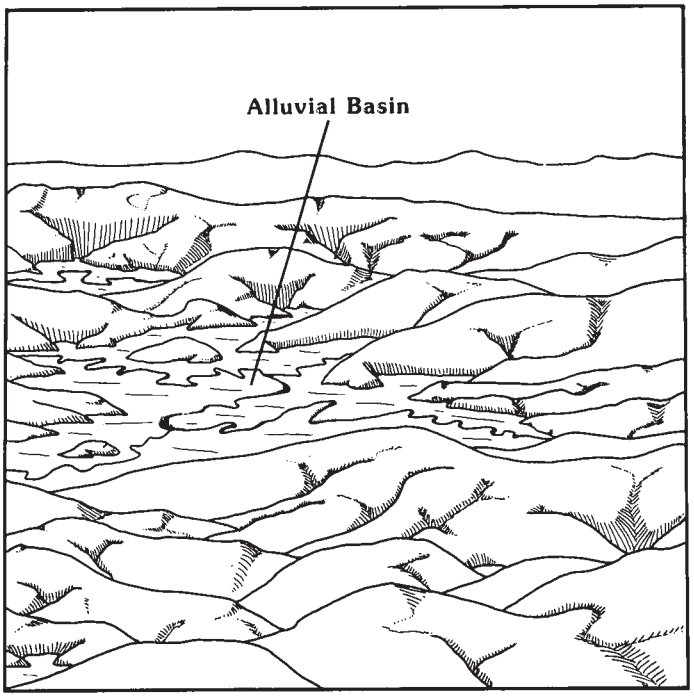

Figure 4.—A large meandering stream in an alluvial basin.

Terraces are relatively flat surfaces bordering a valley floor (fig. 3). They represent the former position of an alluvial plain or lake bottom and can include steep risers between terrace surfaces and valley floors. They are formed by alluvial, glacial outwash, and lacustrine deposits.

Alluvial basins are flat or slightly concave basins filled with alluvium. A large stream bisects these basins (fig. 4). It has relatively gentle channel gradients and tends to meander. Alluvial basins are wider than flood plains. Some contain small ponds, which may have been formed by beaver dams. Soils in alluvial basins have a water table at or near the surface during the growing season.

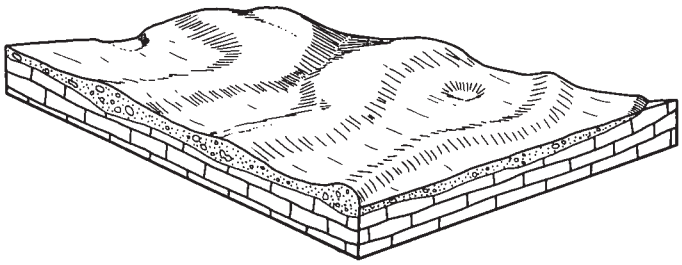

Figure 5.—A hummocky and hilly moraine.

Moraines are glacial drift deposits that have a topography characterized by randomly oriented mounds and depressions (fig. 5). Surface drainage is poor, and many depressions do not have an outlet.

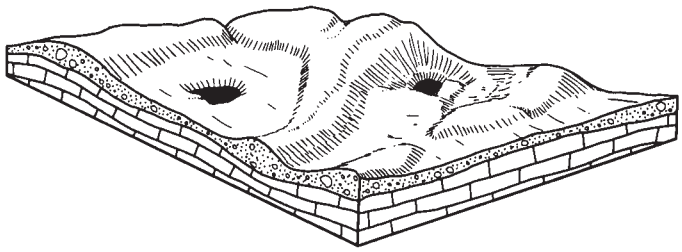

Figure 6.—An area of kames and kettles.

Kames and *kettles* are distinctive morainic landscapes composed of moundlike hills of glacial drift, or kames, in a complex pattern with bowl-shaped depressions, or kettles (fig. 6). Kettles may have been formed by the melting of large blocks of ice buried in the drift. Most kettles have no drainage outlet. Soils on kames and in kettles have a fluctuating water table.

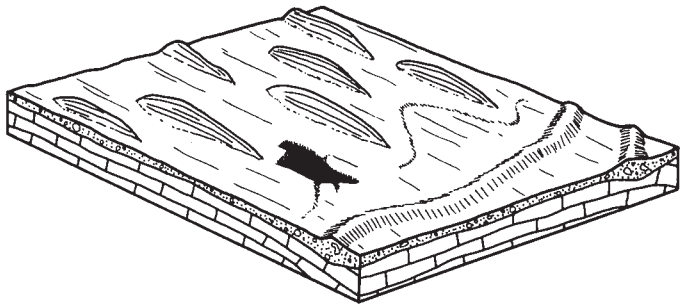

Figure 7.—An area of drumlins.

Drumlins are low, smooth, elongated ridges of glacial till (fig. 7). The longer axis is parallel to the general direction of glacier flow. Drumlins are produced by glacial erosion and deposition on the subglacial floor.

Glacial trough walls are the straight or concave upper slopes in U-shaped glacial valleys (fig. 8). The slopes are very steep, and there are avalanche chutes. Glacial scouring has resulted in areas of rock outcrop and in areas on the upper slopes where the soils are shallow. Deposits of glacial drift are common on the lower slopes.

Cirque headwalls and *alpine ridges* are very steep rock cliffs surrounding glacial cirque basins and the very narrow ridges at the higher elevations above the cirques (fig. 9). The cirques tend to be on northerly aspects and the alpine ridges on southerly aspects.

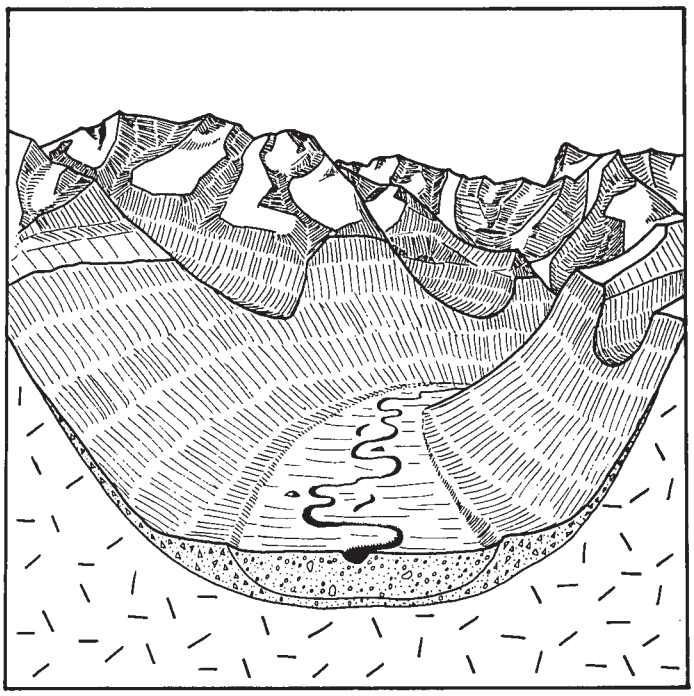

Figure 8.—Glacial trough walls in a U-shaped valley.

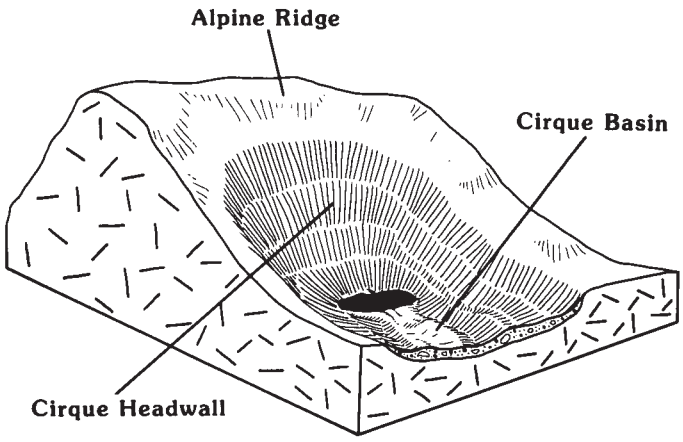

Figure 9.—Glacial cirques have very steep headwalls and a basin, which often contains a small lake. Alpine ridges are very narrow.

Glaciated mountain ridges are rounded mountain ridges that have been overridden by glaciers (fig. 10). Glacial scouring has resulted in areas of rock outcrop

and in areas on the ridge crest where the soils are shallow. Thick deposits of glacial till are on the lower slopes.

Glaciated mountain slopes are mantled by glacial till (fig. 10). Their drainage pattern is usually dendritic, and the drainageways are widely spaced. Slopes are weakly to moderately dissected by low-order streams.

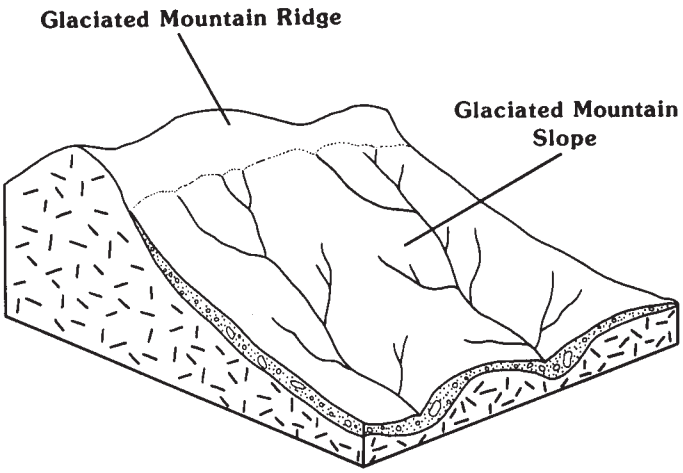

Figure 10.—Glaciated mountain slopes are mantled by glacial till. Rock outcrop and thin deposits of till are in areas of glaciated mountain ridges.

Dissected glaciated mountain slopes are strongly dissected by low-order drainageways. More than half of these mountain slopes are dissected by steep, low-order drainageways. The drainage pattern of dissected glaciated mountain slopes is parallel or dendritic, and the drainageways can be closely spaced. The slopes along low-order drainageways are susceptible to landslides. Sediment delivery efficiency, or the probability of eroded soil reaching a stream channel and becoming sediment, is high because of the closely spaced drainageways and the steep slope.

Mountain slopes are convex or straight slopes that are moderately dissected by low-order drainageways (fig. 11). The soils on these slopes formed in material weathered from the underlying bedrock.

Breaklands have very steep slopes of more than 60 percent. A large amount of rock outcrop and talus is in many areas of breakland. The drainage pattern of breaklands is parallel to dendritic. Sediment delivery efficiency is high because of the steep drainage channels. The slope is a limitation in areas of breakland.

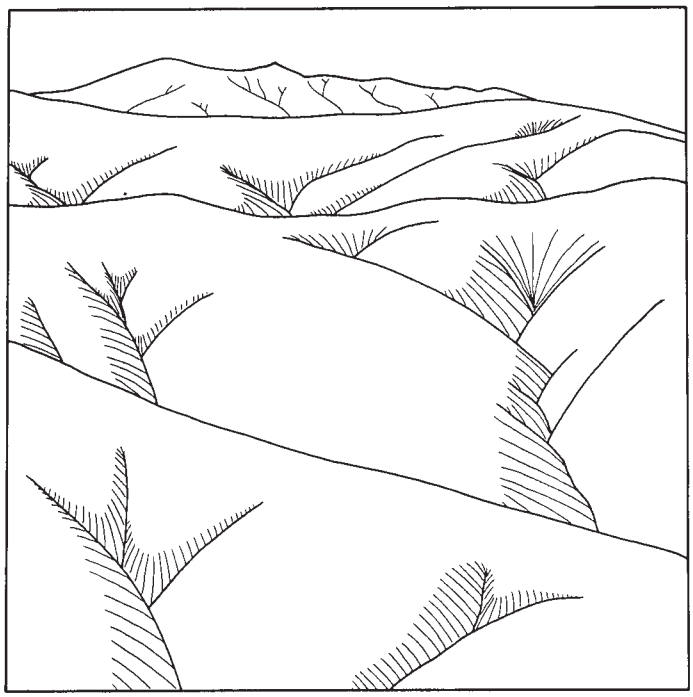

Figure 11.—Mountain slopes have convex upper slopes and ridgetops. Their drainageways are in V-shaped valleys.

Geology

The bedrock in the survey area is predominantly metasedimentary rock of middle Proterozoic age. Quartzite, siltite, argillite, and dolomite are the major kinds of rock. Igneous intrusions, or granitic stocks, metadiorite dikes and sills, and basalt flows, also are present. They have intruded into the metasedimentary rock and are mostly in the western half of the survey area.

Extensive surficial deposits of glacial till, outwash, and lacustrine sediments are in the survey area. The glacial till that was deposited by continental ice sheets tends to be dense and has bulk density of 1.5 to 1.8 grams per cubic centimeter. The till deposited by alpine glaciers is friable and has bulk density of 1.2 to 1.5 grams per cubic centimeter.

Much of the survey area has a surface mantle of loess that has been influenced by volcanic ash. Most of the ash came from the eruption of Mt. Mazama in southwestern Oregon about 6,800 years ago. The layer of ash is on all northerly aspects and on southerly aspects above 4,500 feet. It is thicker and more prevalent in the western half of the survey area because the area is closer to Mt. Mazama and a protective cover of vegetation has minimized erosion.

The cover of vegetation is heavier in this area because of the higher amount of precipitation.

The following geologic groups have similar associated landform and soil properties.

Alluvium is unconsolidated material sorted and deposited by water. The rock fragments generally are rounded. Alluvium forms flood plains, terraces, and alluvial basins along the major streams. Flooding, the fluctuation of the water table, and the need to protect streambanks and channels can limit management of soils that formed in alluvium.

Lacustrine deposits are unconsolidated silts and clays deposited on glacial lake bottoms. These deposits are typically varved with thin sedimentary layers resulting from seasonal variations in deposition. They form terraces that have gently sloping surfaces and steep risers. Soils that formed in lacustrine sediments are erodible when they are exposed by excavation and have low strength when they are wet.

Glacial outwash is material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. It forms terraces that have nearly level surfaces and steep risers. In some areas, the glacial outwash has been reworked by wind and the terraces include depressions and dunes that are characterized by low relief. Soils that formed in glacial outwash have sandy substrata containing rounded pebbles and cobbles.

Compact glacial till is unconsolidated silt, sand, gravel, and boulders deposited by a glacier. It is associated with continental ice sheets. It forms moraines or mantles glaciated mountain slopes and ridges. Soil substrata that formed in compact glacial till are hard and brittle when they are moist and have bulk density of 1.5 to 1.8 grams per cubic centimeter. They restrict the penetration of roots and the movement of water.

Friable glacial till is associated with alpine glaciers. It forms moraines in U-shaped glacial valleys and in cirque basins and mantles glacial troughwalls and glaciated mountain ridges. Soil substrata that formed in friable glacial till have bulk density of 1.2 to 1.5 grams per cubic centimeter. They do not restrict the penetration of roots and the movement of water.

Glacial drift is a combination of compact glacial till and lacustrine deposits in a pattern that is too complex to map separately. It forms kame and kettle topography. Soil substrata that formed in compact glacial till restrict the penetration of roots and the movement of water. Those that formed in lacustrine sediments do not restrict the penetration of roots and the movement of water.

Metasedimentary rocks are mainly argillites, siltites, quartzites, and dolomites of middle Proterozoic age. When weathered, these rocks produce loamy material containing many angular rock fragments. Soils that formed in material weathered from these rocks are on mountain slopes and ridges and glaciated mountain ridges. The content of angular rock fragments is 50 to 85 percent in soil substrata that formed in material weathered from metasedimentary rocks.

Granitic rocks are hard and coarse grained and are in granitic stocks and metadiorite sills. When weathered, these rocks produce sandy material containing many rock fragments. Soils that formed in material weathered from these rocks are on mountain slopes. The content of subangular rock fragments is 50 to 85 percent in soil substrata that formed in material weathered from granitic rocks.

Micaceous rocks weather to produce material containing 40 percent or more mica. They are mostly pyroxenite. Soils that formed in material weathered from these rocks are on mountain slopes. The content of rock fragments is 0 to 35 percent in soil substrata that formed in material weathered from micaceous rocks.

Vegetation

Most of the survey area is forested or has the potential to be forested. Ponderosa pine, Douglas-fir, western larch, grand fir, western white pine, lodgepole pine, western redcedar, western hemlock, subalpine fir, and Engelmann spruce are important tree species. Mountain hemlock, whitebark pine, and alpine larch are important species at the highest elevations. Forest stands reflect the distinct differences in rainfall between the western and eastern portions of the survey area. In the western part (or the Cabinet Range and the western part of the Purcell Range) where the amount of rainfall is higher, western redcedar, western hemlock, and western white pine generally are in the forests at the lower elevations. These species are seldom found in forests in the eastern part (or the Salish Range and the eastern part of the Purcell Range). Subalpine fir and Engelmann spruce are at the higher elevations. They are also in many areas on stream bottoms in the eastern part of the survey area. Their presence on stream bottoms is related to the accumulation of cold air in the areas.

About 1 percent of the survey area is mountain grassland or sedge meadows. The mountain grassland, which includes rough fescue, Idaho fescue, and bluebunch wheatgrass, is in the Tobacco River valley and on the steep, southerly aspects along the lower reaches of the Fisher River. The sedge meadows are in widely scattered areas of the major valleys.

Habitat Types

Habitat types are considered to be basic ecological subdivisions of landscapes. Each is recognized by distinctive combinations of overstory and understory plant species at climax. They are named for the dominant or characteristic vegetation of the climax community. Habitat types are useful in soil surveys when assessing the combined effects of aspect, slope, elevation, and soil properties on potential plant growth. The habitat types were important in estimating productivity and limitations to forest regeneration in this survey. Forest habitat types are defined in "Forest Habitat Types of Montana" *(4)*, and grassland habitat types are defined in "Grassland and Shrubland Habitat Types of Western Montana" *(3)*.

Habitat types often have similar implications for the kind of interpretive uses made of them in soil surveys. Habitat types with similar implications for soil survey objectives are grouped in this report. Group names are used throughout the report. The groups are described in the following paragraphs.

Open-grown forest is made of habitat types on which forest stands are mostly mixed Douglas-fir and ponderosa pine. Forest stands are open grown with scattered individual trees or clumps of trees. Major habitat types are Douglas-fir/bluebunch wheatgrass, ponderosa pine/bitterbrush, and Douglas-fir/rough fescue.

This habitat type group is mainly on slopes that have a southerly aspect in scattered areas throughout the eastern and southern parts of the survey area. It is commonly included in map units that are dominantly mountain grassland.

Dry, mixed forest is made of habitat types on which forest stands are mostly Douglas-fir, lodgepole pine, ponderosa pine, and western larch. Major habitat types are Douglas-fir/pinegrass, Douglas-fir/snowberry, and Douglas-fir/ninebark. Douglas-fir/twinflower, Douglas-fir/bearberry, and Douglas-fir/dwarf huckleberry are included in many of the map units and have similar management implications.

This habitat type group is moderately extensive. It is at the lower elevations in the eastern part of the survey area.

Moist, mixed forest is made of habitat types on which western hemlock, western redcedar, subalpine fir, Engelmann spruce, and western white pine are potential stand components. These species can be part of the overstory or can be successfully reproducing in the understory. Most of the other tree species found in the survey area also can be stand components. Major habitat types are western redcedar/queencup beadlily, western hemlock/queencup beadlily, and subalpine fir/queencup beadlily. Subalpine fir/menziesia, subalpine fir/blue huckleberry, subalpine fir/twinflower, and subalpine fir/devil's club are all included in places and have similar management implications.

This habitat type group is extensive throughout the survey area.

Subalpine forest is made of habitat types on which forest stands are mostly mixed lodgepole pine, whitebark pine, mountain hemlock, subalpine fir, and Engelmann spruce. Forest stands can be closed canopy or open grown. Major habitat types are subalpine fir/beargrass, mountain hemlock/beargrass, and subalpine fir/grouse whortleberry. Subalpine fir/woodrush, alpine larch/subalpine fir, and whitebark pine/subalpine fir are included in many of the map units and have similar management implications.

This habitat type group is of minor extent. It is at elevations of 4,000 to 8,700 feet.

Mountain grassland is made of habitat types on which vegetation is dominated by bunchgrasses. Major grass species are rough fescue, Idaho fescue, bluebunch wheatgrass, and prairie junegrass. A wide variety of forbs and shrubs are generally included. Major habitat types are Idaho fescue/bluebunch wheatgrass and rough fescue/Idaho fescue.

This habitat type group is of minor extent. It is at low elevations in the Tobacco River valley.

Wet meadows are a complex of community types dominated by sedges, rushes, and other grasses and forbs that grow on moist or wet sites. Associated shrub and hardwood forest communities include black cottonwood, quaking aspen, paper birch, Sitka alder, willow, redosier dogwood, or Rocky Mountain maple.

How This Survey Was Made

The survey area is mountainous and heavily forested. Mapping techniques used in other survey areas were impractical because access in the area is difficult. The mapping techniques used relied heavily on plotting map unit boundaries using features visible on aerial photography. Most commonly, these features were landforms or natural vegetation. Also, geologic maps were studied and the elevation of the site was considered when the map unit boundaries were plotted. Observations were made along field transects and traverses through representative delineations of the map units. Relationships between properties important to survey objectives and features visible on aerial photography were observed. Sometimes different features were used to plot map unit boundaries as a result of field checking. Reliable relationships between photographic features and map unit properties were

established. These properties were observed and described in the field. Physical and chemical properties of soils that cannot be measured with field techniques were derived from laboratory characterization of soils within the survey area and similar soils in adjacent areas.

Table 2 lists the most important features used to plot the boundaries of the map units. Landform, slope, parent material, vegetation, aspect, elevation, and rock outcrop are described under the headings "Physiography," "Geology," and "Vegetation." The map units in this survey are described under the headings "General Soil Map Units" and "Detailed Soil Map Units."

General Soil Map Units

The general soil map at the back of this publication shows broad areas that have similar topography and soil patterns. Typically, a map unit consists of one or more major soils and some minor soils.

The general soil map can be used to compare the suitability of large areas for common land uses. The map is not suitable for planning the use of small areas because of its small scale.

Soils on Terraces

The landscape is characterized by nearly level to rolling terraces that have steep risers.

1. Soils formed in glacial outwash and alluvium; dry

This map unit is north of Eureka and east of Lake Koocanusa. The average annual precipitation is about 14 inches. The vegetation consists of mountain grassland with some open-grown forest.

This map unit makes up about 1 percent of the survey area. It is about 75 percent Typic Xerochrepts, 15 percent Calcixerollic Xerochrepts, and 10 percent soils of minor extent.

The Typic Xerochrepts have a surface layer and subsoil of very gravelly sandy loam and a substratum of extremely gravelly loamy sand or extremely gravelly sand.

The Calcixerollic Xerochrepts are very fine sandy loam to loamy fine sand. They have lime in the subsoil and substratum.

The soils of minor extent are fine-silty, mixed Typic Xerochrepts. They formed in lacustrine deposits.

Livestock grazing is the major land use in this map unit. Forage productivity is high. Disturbed areas of soil are difficult to revegetate because of drought in summer.

2. Soils formed in glacial outwash and alluvium; moist

This map unit is in the major valleys in the western part of the survey area. The average annual precipitation is 20 to 40 inches. The vegetation consists of moist, mixed forest.

This map unit makes up about 2 percent of the survey area. It is about 60 percent Andic Dystrochrepts, 25 percent Eutrochrepts, and 15 percent soils of minor extent.

The surface layer of the major soils is loess that has been influenced by volcanic ash. It is 7 to 14 inches thick. The Andic Dystrochrepts are underlain by gravelly outwash. The Eutrochrepts are underlain by very fine sandy loam and loamy fine sand outwash that has been reworked by wind. They have lime in the subsoil and substratum. The Andic Dystrochrepts do not have lime in the subsoil or substratum.

Of minor extent in this map unit are soils in wet meadows.

Timber productivity is high in this map unit. A major stream is generally in the unit. The protection of streambanks and channels is a major concern of watershed management.

3. Soils formed in lacustrine sediments

This map unit is in the major valleys. The average annual precipitation is 20 to 40 inches. The vegetation consists of moist, mixed forest.

This map unit makes up about 4 percent of the survey area. It is about 45 percent Andic Dystric Eutrochrepts, 45 percent Eutric Glossoboralfs, and 10 percent soils of minor extent.

The surface layer of the major soils is loess that has been influenced by volcanic ash. It is 7 to 14 inches thick. The subsoil and substratum are silt loam and silty clay loam. The Eutric Glossoboralfs have an accumulation of clay in the subsoil. The Andic Dystric Eutrochrepts do not have an accumulation of clay in the subsoil.

The soils of minor extent are Andic Dystrochrepts. They are along drainageways and on terrace risers. They have a substratum of very gravelly sand.

Timber productivity is moderate or high in this map unit. The subsoil and substratum erode when they are exposed during road construction or logging. The silty sediments produced by the erosion of these soils is potentially damaging to fish habitat.

Soils on Moraines and Glaciated Mountain Slopes

The landscape is characterized by gently sloping to very steep moraines and mountain slopes that are mantled with glacial till. The underlying till is dense and brittle. It restricts the movement of water and the penetration of roots.

4. Soils formed in calcareous glacial till

This map unit is on moraines and glaciated mountain slopes in the drier eastern half of the survey area. The soils are underlain by glacial till that has been influenced by limestone. The vegetation consists of moist, mixed forest or dry, mixed forest.

This map unit makes up about 14 percent of the survey area. It is about 50 percent Typic Eutroboralfs, 25 percent Typic Eutrochrepts, and 25 percent soils of minor extent.

The major soils have lime in the lower part of the subsoil and in the substratum. The Typic Eutroboralfs have an accumulation of clay in the subsoil. The Typic Eutrochrepts do not an accumulation of clay in the subsoil.

The soils of minor extent are Dystric Eutrochrepts and Eutric Glossoboralfs. They do not have lime in the lower part of the subsoil or in the upper part of the substratum.

Timber productivity is moderate or high in this map unit. The slope limits the operation of tractors in places.

5. Soils formed in noncalcareous glacial till

This map unit is on moraines and mountain slopes in the northern three-fourths of the survey area. The soils are underlain by glacial till primarily weathered from quartzite, argillite, siltite, and similar noncalcareous metasedimentary rocks. The vegetation mainly consists of moist, mixed forest.

This map unit makes up about 50 percent of the survey area. It is about 45 percent Andic Dystrochrepts, 45 percent Andic Cryochrepts, and 10 percent soils of minor extent.

The surface layer of the major soils is loess that has been influenced by volcanic ash. It is 7 to 14 inches thick. The Andic Dystrochrepts are below elevations of 5,000 feet, and the Andic Cryochrepts are above elevations of 5,000 feet.

The soils of minor extent are Lithic Cryochrepts and Dystric Eutrochrepts. The Lithic Cryochrepts are on ridges at the higher elevations. They have bedrock within a depth of 20 inches. The Dystric Eutrochrepts are on steep southerly aspects. Their surface layer, which is loess, is mixed with the underlying material.

Timber productivity is moderate or high in this map unit. The slope limits the operation of tractors in places.

Soils in Glacial Cirques and on Trough Walls

The landscape is characterized by steep or very steep glacial cirque headwalls and the upper slopes of U-shaped glacial valleys. Gently sloping to steep moraines are in cirque basins and on glacial valley bottoms. The underlying till is friable. It is easily penetrated by roots and infiltrated by water.

6. Soils formed in material weathered from metasedimentary rock or in glacial till

This map unit is at the higher elevations throughout the survey area. It is in scattered areas but is mostly in areas of the Whitefish Range, Cabinet Mountains, and Northwest Peak and along the Bitterroot Divide. The vegetation mainly consists of subalpine forest with some moist, mixed forest in the valley bottoms.

This map unit makes up about 16 percent of the survey area. Andic Cryochrepts, Lithic Cryochrepts, and rock outcrop each make up about one-third of the unit.

The surface layer of the major soils is loess that has been influenced by volcanic ash. It is 7 to 14 inches thick. The Andic Cryochrepts are on moraines and the lower valley slopes. They are deep. The Lithic Cryochrepts and the rock outcrop are on the upper valley side slopes and cirque headwalls. The Lithic Cryochrepts have bedrock within a depth of 20 inches.

Timber productivity is high on moraines in the valley bottoms and low or very low in the other areas. The harsh subalpine climate limits forest regeneration and productivity on cirque headwalls and upper slopes. Machine operation is limited by the slope and the rock outcrop on the cirque headwalls and upper troughwalls. This map unit is scenic and has relatively high value for recreational activities. It is an important source of late summer streamflow.

Soils on Breaklands and Mountain Slopes

The landscape is characterized by very steep slopes that are adjacent to major rivers. The slopes dominantly are 45 to 100 percent. The soils are underlain by material weathered from the underlying bedrock.

7. Soils on breaklands and mountain slopes; dry

This map unit is on breaklands that have southerly aspects. The vegetation consists of dry, mixed forest or open-grown forest.

This map unit makes up about 4 percent of the survey area. It is about 35 percent Typic Ustochrepts, 30 percent Lithic Ustochrepts, 20 percent rock outcrop, and 15 percent soils of minor extent.

The Typic Ustochrepts have bedrock at a depth of 20 to 60 inches or more. They are on the lower slopes and along drainageways. The Lithic Ustochrepts have

bedrock within a depth of 20 inches. They are on the upper slopes and near areas of the rock outcrop. The rock outcrop is in areas throughout the unit.

The soils of minor extent are Typic Calcixerolls. They are underlain by limestone bedrock.

This map unit has potential as winter range for wildlife. Snow cover seldom limits access to forage. Drainage channels are steep and rapidly deliver sediments to the larger streams at the base of slopes. The hard bedrock and the slope limit excavation during road construction.

8. Soils on breaklands and mountain slopes; moist

This map unit is in the southern one-fourth of the survey area on breaklands that have northerly aspects. The vegetation mainly consists of moist, mixed forest.

This map unit makes up about 9 percent of the survey area. It is about 40 percent Andic Dystrochrepts, 35 percent Andic Cryochrepts, and 25 percent components of minor extent.

The surface layer of the major soils is loess that has been influenced by volcanic ash. It is 7 to 14 inches thick. The Andic Dystrochrepts are below elevations of 5,000 feet, and the Andic Cryochrepts are above elevations of 5,000 feet.

Of minor extent in this map unit are Lithic Cryochrepts, Typic Ustochrepts, and rock outcrop. The Lithic Cryochrepts and the rock outcrop are on ridges at the higher elevations. The Lithic Cryochrepts have bedrock within a depth of 20 inches. The Typic Ustochrepts are on southerly aspects. Their surface layer, which is loess, is mixed with the underlying material.

Timber productivity is high in this map unit. The slope limits the operation of tractors in places.

Detailed Soil Map Units

This section describes each map unit in detail. The map unit descriptions, along with the soil maps, can be used to determine the suitability and potential of a unit for major land uses within the survey area, to plan land use and the development of resources, and to help protect and maintain the quality of the environment. The acreage of each map unit is given in table 3. Table 4 provides an alphabetical listing of the detailed soil map unit names. Many of the terms used to describe map units are defined in the "Glossary." More information for each map unit is given under the heading "Use and Management of the Soils."

Most of the soils in the survey area are mapped at the family level of taxonomy, but a few are mapped at the higher levels. Map units in which soils were mapped at the family level are named using subgroup reference taxa for brevity. Table 10 gives the classification of the soils in each of the detailed soil map units.

The map unit description format presents information in sections. A description of the content of each section follows.

An introductory paragraph provides a summary of the map unit information. It describes landform, elevation, vegetation, and parent material.

Landform gives properties of the landform in the map unit. Slope gradient, the pattern and density of drainageways, and a description of the drainage channels are given. Seeps, springs, lakes, and other landform features that occur also are described.

Vegetation and *habitat types* describe the typical existing vegetation and the composition and distribution of habitat types. Major and similar habitat types are in the same habitat type group and have similar interpretive values for survey objectives. Included habitat types have similar productivity as major habitat types, but they can have different stand composition. Dissimilar habitat types have significantly different potential productivity or limitations to forest regeneration than the major habitat types.

Geology describes the bedrock underlying the soils or the properties of the geologic deposits in which the soils formed. The use of geology in defining, describing, and interpreting map units is described in the section "General Nature of the Survey Area."

Characteristics of the soils describes the soil properties that are of particular importance to use and management. The properties given are the same for the dominant soils and the similar soils in the unit. The texture of the surface layer, the thickness of the surface layer when it is loess that has been influenced by volcanic ash, the content of rock fragments in the subsoil, drainage, and depth to bedrock, if less than 60 inches, are important properties in this survey area. When the map unit is a complex, the most important properties of the soils and any relationship of the soils to topographic position or vegetation are described.

Map unit composition describes the soils that are similar and dissimilar to the dominant soils. It gives the percentage of the map unit typically occupied by the dominant and similar soils and by the dissimilar soils. The location and principal interpretive difference are given for dissimilar soils.

Representative profile of the soils describes the dominant soils in the map unit. It is not necessarily the same as the representative pedon for the taxa.

Management gives suitability and limitations for common land uses. *Timber, roads, watershed, wildlife and fisheries,* and *recreation and visual quality* are described.

101—Fluvents, flood plains

This map unit is on flood plains. Elevation ranges from 1,800 to 4,200 feet. The vegetation consists of moist, mixed forest. The soils formed in alluvial deposits.

Landform

The dominant slopes have gradients of 0 to 10 percent. The flood plains are along streams and are subject to flooding in spring when the snow melts. The streams have braided channels and change course frequently.

Vegetation

The vegetation is a mixed forest of western redcedar, western hemlock, subalpine fir, Engelmann spruce,

black cottonwood, paper birch, quaking aspen, and Rocky Mountain maple. Subalpine fir and Engelmann spruce grow in areas where cold air accumulates. The forest understory is dominated by willow, Sitka alder, redosier dogwood, and a wide variety of forbs and grasses. Occasional flooding disturbs the vegetation. As a result of the flooding, the vegetation is a mixture of shrubs, deciduous forest, and coniferous forest in different successional stages. Generally, about 20 percent of the unit supports shrubs.

Habitat Types

Western redcedar/queencup beadlily and western hemlock/queencup beadlily are the major habitat types. Subalpine fir/queencup beadlily is a similar habitat type. These habitat types are in about 85 percent of the unit.

Dissimilar habitat types are in about 15 percent of the unit. Subalpine fir/devil's club and western redcedar/devil's club are in very small, wet areas close to the streams.

Geology

These soils are underlain by stratified alluvial deposits of sand, silt, and gravel.

Characteristics of the Soils

These soils have a medium textured surface layer. They are occasionally flooded in spring when the snow melts. The water table fluctuates between depths of 24 and 60 inches. The subsoil contains rounded rock fragments.

Map Unit Composition

The dominant soils are Fluvents. Unlike the Fluvents, Ochrepts, which are similar soils, have a weakly developed subsoil. The dominant and similar soils make up about 90 percent of the unit.

Umbrepts, which are dissimilar soils, make up about 10 percent of the unit. They have a dark surface layer. They are in depressions and have a water table that fluctuates between depths of 0 and 24 inches in spring when the snow melts.

Representative Profile of the Soils

No one profile can represent the dominant soils in this unit. In one of the most common profiles, however, the soils have a 2-inch mat of litter and duff overlying a surface layer of dark yellowish brown gravelly silt loam. The surface layer is about 9 inches thick. The substratum to a depth of 60 inches or more is yellowish brown very gravelly sandy loam and sand.

Management

Timber

The potential annual production is high in forested areas. Productivity in the map unit is limited by openings in the forest. During site preparation stones and cobbles from the subsoil can be mixed with the soil in the surface layer. These stones and cobbles can affect planting. Regeneration of the forest is limited by frost pockets in low areas.

Roads

Tread erosion tends to remove fine textured material from unsurfaced roads. The remaining gravel and cobbles form a rough surface.

Watershed

The major concern of watershed management is the protection of streambanks and channels. Carefully locating bridges and culverts helps to maintain the stability of the channels. Changes in the channel can result in a large amount of sediment. Disturbing the soils on or adjacent to the streambanks can result in severe sedimentation. Erosion is a moderate hazard along skid trails and fire lines. The material exposed by road construction has a severe hazard of erosion. Sediment delivery efficiency is high.

Wildlife and fisheries

This map unit commonly supports large cottonwoods, which can provide cavity habitat and nesting habitat for birds. It can provide important habitat for whitetail deer and furbearers year round and for grizzly bears in spring and fall. The streams generally provide spawning habitat for trout and whitefish.

Recreation and visual quality

Fishing and swimming are common recreational activities in areas of this map unit. Maintaining the visual quality of the unit is relatively easy.

102—Andic Dystric Eutrochrepts, lacustrine terraces

This map unit is on terraces. Elevation ranges from 2,000 to 3,700 feet. The vegetation consists of moist, mixed forest. The soils formed in lacustrine deposits.

Landform

The dominant slopes on terrace surfaces have gradients of 0 to 15 percent. Terrace risers have slopes of 30 to 60 percent. The terraces have a dendritic drainage pattern. The terrace risers have short, deeply incised drainageways.

Vegetation

The vegetation is a mixed forest of western hemlock, western redcedar, grand fir, western larch, Douglas-fir, and lodgepole pine. Subalpine fir and Engelmann spruce grow along drainageways. The forest understory is dominated by shrubs and forbs.

Habitat Types

Habitat types vary in this map unit depending on location. In the Cabinet Range and the western part of the Purcell Range, western redcedar/queencup beadlily and western hemlock/queencup beadlily are the major habitat types. Grand fir/queencup beadlily and grand fir/twinflower are similar habitat types. In the Salish Range and the eastern part of the Purcell Range, Douglas-fir/twinflower is the major habitat type. Douglas-fir/ninebark is a similar habitat type. These habitat types are in 100 percent of the unit.

Geology

These soils are underlain by silt loam and silty clay loam glacial lake sediments. They have thin layers of dark sediments alternating with lighter colored layers.

Characteristics of the Soils

These soils have a surface layer of loess that has been influenced by volcanic ash. The surface layer is 4 to 14 inches thick. It is medium textured. The content of rounded rock fragments in the subsoil ranges from 0 to 15 percent.

Map Unit Composition

The dominant soils are fine-silty, mixed, frigid Andic Dystric Eutrochrepts. They have a surface layer of loess 7 to 14 inches thick and do not have an accumulation of clay in the subsoil. The similar soils have a surface layer of loess 4 to 7 inches thick or have an accumulation of clay in the subsoil. They are fine-silty, mixed, frigid Dystric Eutrochrepts and fine-silty, mixed Eutric Glossoboralfs. The dominant and similar soils make up about 90 percent of the unit.

Dissimilar soils make up about 10 percent of the unit. They are loamy-skeletal, mixed, frigid Andic Dystrochrepts. They formed in glacial outwash deposits and have a very gravelly subsoil and substratum. Their productivity for timber is lower than that of the dominant soils.

Representative Profile of the Soils

The dominant soils have a surface layer of light yellowish brown silt loam about 9 inches thick. The upper part of the subsoil is white silt loam about 22 inches thick. The lower part is pale yellow very fine sandy loam about 24 inches thick. The substratum to a depth of 60 inches or more is white very fine sandy loam.

Management

Timber

The potential annual production is high in the Cabinet Range and the western part of the Purcell Range and moderate in the Salish Range and the eastern part of the Purcell Range. The soil in the surface layer can be displaced and the subsoil exposed when sites are prepared for planting and when tractors are operated on the sites. Frost heaving can damage seedlings that are planted in the subsoil.

Roads

Roadcuts along the terrace risers tend to slough. If unsurfaced roads are traveled when the soils are wet, the formation of ruts is a hazard. Surface crusting limits revegetation in areas where the substratum has been exposed during road construction. Seeding these areas as soon as possible after construction helps to ensure successful revegetation.

Watershed

Erosion is a moderate hazard along skid trails and fire lines. The material exposed by road construction has a severe hazard of erosion. The sediment that results from the erosion of these soils is particularly damaging to the spawning habitat of fish. Sediment delivery efficiency is low.

Wildlife and fisheries

This map unit can provide habitat for whitetail deer in winter. It commonly includes mineral licks for big game. The streams generally provide habitat for trout and whitefish.

Recreation and visual quality

Hunting and gathering wood are common recreational activities in areas of this map unit. Maintaining the visual quality of the unit is relatively easy; however, roadcuts are obtrusive if they are not vegetated.

103—Andic Dystrochrepts, alluvial terraces

This map unit is on terraces. Elevation ranges from 2,000 to 3,500 feet. The vegetation consists of moist, mixed forest. The soils formed in alluvial deposits.

Landform

The dominant slopes on terrace surfaces have gradients of 0 to 15 percent. Terrace risers have slopes of 30 to 60 percent. The terraces are adjacent to major streams. They have no surface drainage channels. Small flood plains are in this unit.

Vegetation

The vegetation is a mixed forest of western hemlock, western redcedar, grand fir, western larch, Douglas-fir, and lodgepole pine. Subalpine fir and Engelmann spruce grow along drainageways. The forest understory is dominated by shrubs and forbs.

Habitat Types

Western redcedar/queencup beadlily and western hemlock/queencup beadlily are the major habitat types. Subalpine fir/queencup beadlily, Engelmann spruce/queencup beadlily, grand fir/queencup beadlily, and grand fir/twinflower are similar habitat types. These habitat types are in about 85 percent of the unit.

Douglas-fir/twinflower, which is a dissimilar habitat type, is in about 15 percent of the unit. It is on the terrace risers. Its productivity for timber is lower than that of the major habitat types.

Geology

These soils are underlain by stratified alluvial deposits of sand, silt, and gravel.

Characteristics of the Soils

These soils have a surface layer of loess that has been influenced by volcanic ash. The surface layer is 4 to 14 inches thick. It is medium textured. The content of rounded rock fragments in the subsoil ranges from 35 to 50 percent.

Map Unit Composition

The dominant soils are loamy-skeletal, mixed, frigid Andic Dystrochrepts. They have a surface layer of loess 7 to 14 inches thick. The similar soils have a surface layer of loess 4 to 7 inches thick. They are loamy-skeletal, mixed, frigid Typic Dystrochrepts. The dominant and similar soils make up about 90 percent of the unit.

Dissimilar soils make up about 10 percent of the unit. They are fine-silty, mixed, frigid Andic Dystric Eutrochrepts. They formed in lacustrine deposits. They have a subsoil and substratum of silt loam or silty clay loam. Their productivity for timber is higher than that of the dominant soils.

Representative Profile of the Soils

The dominant soils are yellowish brown gravelly silt loam in the upper 7 inches of the surface layer. They are very pale brown very gravelly very fine sandy loam in the lower 13 inches of the surface layer. The subsoil is strong brown very gravelly very fine sandy loam about 21 inches thick. The substratum to a depth of 60 inches or more is pale brown very cobbly coarse sand.

Management

Timber

The potential annual production is high. During site preparation stones and cobbles from the subsoil can be mixed with the soil in the surface layer. These stones and cobbles can affect planting.

Roads

Tread erosion tends to remove fine textured material from unsurfaced roads. The remaining gravel and cobbles form a rough surface.

Watershed

The major concern of watershed management is the protection of streambanks and channels. Carefully locating bridges and culverts helps to maintain the stability of the channels. Changes in the channel can result in a large amount of sediment. Disturbing the soils on or adjacent to the streambanks can result in severe sedimentation. Erosion is a moderate hazard along skid trails and fire lines. The material exposed by road construction has a severe hazard of erosion. Sediment delivery efficiency is high.

Wildlife and fisheries

This map unit can provide habitat for whitetail deer in winter. The streams provide spawning habitat for trout and whitefish.

Recreation and visual quality

Hunting, fishing, camping, and gathering wood are common recreational activities in areas of this map unit. Maintaining the visual quality of the unit is relatively easy.

104—Andic Dystrochrepts-Umbric Vitrandepts complex, kames and kettles

This map unit is on kames and in kettles. Elevation ranges from 2,500 to 4,000 feet. The vegetation consists of moist, mixed forest. The soils formed in glacial drift.

Landform

The dominant slopes have gradients of 5 to 35 percent. The kames and kettles occur in a complex pattern of knolls and depressions. The drainage pattern is deranged. The kettles contain many bogs and marshes.

Vegetation

The vegetation is a mixed forest of western hemlock, western redcedar, western white pine, western larch, grand fir, Douglas-fir, lodgepole pine, black cottonwood, paper birch, quaking aspen, and Engelmann spruce. The forest understory is dominated by shrubs and forbs.

Habitat Types

Habitat types vary in this map unit depending on location. On kames the major habitat types are western redcedar/queencup beadlily and western hemlock/queencup beadlily. Grand fir/queencup beadlily and grand fir/twinflower are similar habitat types on the kames. These habitat types are in about 75 percent of the unit. Black cottonwood, quaking aspen, and paper

birch community types are in the kettles. They are in about 15 percent of the unit.

Dissimilar habitat types are in about 10 percent of the unit. Engelmann spruce and subalpine fir habitat types are along the edge of kettles. The kettles support coniferous forest.

Geology

The soils on the kames are underlain by dense, brittle glacial till. The soils in the kettles are underlain by silty lacustrine sediments or dense, brittle glacial till.

Characteristics of the Soils

Both of these soils have a medium textured surface layer. Their properties vary depending on the location of the soils. The soils on kames are well drained. They have a surface layer of loess that has been influenced by volcanic ash. The surface layer is 4 to 14 inches thick. It is light colored. The content of rounded rock fragments in the subsoil ranges from 20 to 50 percent. The substratum is dense and brittle when moist. The soils in kettles are wet and have low strength. They also have a surface layer of loess that has been influenced by volcanic ash. The surface layer is 14 to 28 inches thick. The upper 7 to 14 inches of the surface layer is dark. The content of rounded rock fragments in the subsoil ranges from 0 to 35 percent.

Map Unit Composition

The dominant soils on kames are loamy-skeletal, mixed, frigid Andic Dystrochrepts. They have a surface layer of loess 7 to 14 inches thick. Their content of rock fragments in the subsoil ranges from 35 to 50 percent. The similar soils have a surface layer of loess 4 to 7 inches thick. Their content of rock fragments in the subsoil ranges from 20 to 35 percent. They are loamy-skeletal, mixed, frigid Typic Dystrochrepts and fine-loamy, mixed, frigid Andic Dystrochrepts. These dominant and similar soils make up about 75 percent of the unit.

The dominant soils in kettles are medial over loamy, mixed, frigid Umbric Vitrandepts. They make up about 15 percent of the unit.

The components of this unit occur in areas so intricately mixed that it was not practical to map them separately at the scale used.

Dissimilar soils make up about 10 percent of the unit. They are fine-silty, mixed Eutric Glossoboralfs. They are near the edge of kettles. They are well drained. Their vegetation is moist, mixed forest.

Representative Profile of the Soils

The loamy-skeletal, mixed, frigid Andic Dystrochrepts are yellowish brown gravelly silt loam in the upper 7 inches of the surface layer. They are very pale brown very gravelly very fine sandy loam in the lower 13 inches of the surface layer. The subsoil is strong brown very gravelly very fine sandy loam about 21 inches thick. The substratum to a depth of 60 inches or more is dense, brittle, pale brown very gravelly very fine sandy loam.

The Umbric Vitrandepts are very dark brown and very dark grayish brown silt loam in the upper 10 inches of the surface layer. They are yellowish brown silt loam in the lower 11 inches of the surface layer. The substratum to a depth of 60 inches or more is light gray and pale olive silt.

Management

Timber

The potential annual production is high in forested areas. Productivity on the site is highly dependent on the loess surface layer. For example, if tractors are operated on the site, the loess surface layer can become compacted or be displaced or it can be mixed with subsoil material. As a result, productivity may be lower than it would have been if tractors had not been operated on the site. Regeneration of the forest is limited by frost pockets in low areas. Trees are susceptible to windthrow because the dense, brittle substratum restricts root penetration.

Roads

On kames, material exposed in cutbanks during road construction tends to slough if the cutbanks are steep. Tread erosion tends to remove fine textured material from unsurfaced roads. The remaining gravel and cobbles form a rough surface. Surface crusting limits revegetation in areas where the substratum has been exposed during construction. Seeding these areas as soon as possible after construction helps to ensure successful revegetation. In kettles, the wetness is a limitation affecting the location and construction of roads. Providing suitable subgrade material helps to prevent the damage caused by wetness and low strength.

Watershed

Erosion is a severe hazard along skid trails and fire lines and in areas where soil material has been exposed by road construction. Operating equipment in the kettles can result in the formation of ruts and in puddling. Sediment delivery efficiency is low.

Wildlife and fisheries

This map unit can provide diverse habitat for whitetail deer throughout the year. It commonly supports cottonwoods, which provide cavity nesting habitat for birds, in areas adjacent to the kettles. The kettles can provide good habitat for moose. The kames commonly provide old growth forest habitat.

Recreation and visual quality

Hunting, viewing wildlife, picking huckleberries, gathering wood, and sightseeing by car are common recreational activities in areas of this map unit. Maintaining the visual quality of the unit is relatively easy.

105—Aquic Udifluvents, poorly drained

This map unit is in alluvial basins. Elevation ranges from 2,000 to 4,000 feet. The vegetation consists of wet meadows. The soils formed in alluvial deposits.

Landform

The dominant slopes have gradients of 0 to 5 percent. The alluvial basins are in valley bottoms. Some are ponded by beaver dams. Others are the site of former lakes or ponds and have no well defined drainage outlet. Some contain small, shallow ponds.

Vegetation

The vegetation is mostly a wet meadow community dominated by sedges and rushes. It includes shrub communities that are dominated by black cottonwood, quaking aspen, paper birch, Rocky Mountain maple, Sitka alder, redosier dogwood, and willow. Engelmann spruce also is included on knolls and around the edge of meadows.

Habitat Types

The habitat types have not been defined for the vegetation in this unit.

Geology

These soils are underlain by stratified alluvial deposits of sand, silt, and gravel.

Characteristics of the Soils

These soils are poorly drained and have a medium textured surface layer. The content of rounded rock fragments in the substratum ranges from 15 to 35 percent.

Map Unit Composition

The dominant soils are coarse-loamy, mixed, frigid Aquic Udifluvents. They make up about 90 percent of the unit.

Dissimilar soils make up about 10 percent of the unit. They are loamy-skeletal, mixed Andic Dystric Eutrochrepts. They are near delineation boundaries. They are well drained and forested.

Representative Profile of the Soils

The dominant soils have a surface layer of very dark grayish brown silt loam about 7 inches thick. The underlying material to a depth of 60 inches or more is stratified very pale brown and light reddish brown very gravelly sandy loam, extremely gravelly sandy loam, silt loam, and fine sandy loam. It is mottled with brownish yellow and strong brown.

Management

Timber

This map unit contains only scattered stands of trees. It is poorly suited to woodland managed for timber.

Roads

The wetness is a limitation affecting the location and construction of roads. Providing suitable subgrade material helps to prevent the damage caused by wetness and low strength.

Watershed

Operating equipment on these soils can result in the formation of ruts and in puddling. The material exposed by road construction has a severe hazard of erosion. Sediment delivery efficiency is low.

Wildlife and fisheries

This map unit can provide habitat for a wide variety of wildlife species including waterfowl and big game species, such as moose, bear, and deer. Many nests of songbirds are in trees along the edge of the mapped areas. Muskrat, beaver, and other furbearers inhabit this unit. Pools and beaver ponds provide habitat for resident brook trout and some cutthroat trout; however, the amount of spawning habitat is limited.

Recreation and visual quality

Fishing and viewing wildlife are common recreational activities in areas of this map unit. Maintaining the visual quality of the unit is relatively easy.

106—Andic Dystrochrepts, glacial outwash terraces

This map unit is on terraces. Elevation ranges from 2,500 to 4,000 feet. The vegetation consists of moist, mixed forest. The soils formed in glacial outwash deposits.

Landform

The dominant slopes have gradients of 0 to 15 percent. The terraces are on the highest part of valleys. They are adjacent to steep mountain slopes or are in areas where tributary streams enter major valleys. They have a weakly defined, dendritic drainage pattern.

Vegetation

The vegetation is a mixed forest of western hemlock, western redcedar, grand fir, western larch, Douglas-fir,

and lodgepole pine. The forest understory is dominated by shrubs and forbs.

Habitat Types

Western hemlock/queencup beadlily and western redcedar/queencup beadlily are the major habitat types. The Engelmann spruce and subalpine fir habitat types along drainageways are similar habitat types. These habitat types are in about 85 percent of the unit.

Dissimilar habitat types are in about 15 percent of the unit. The grand fir and Douglas-fir habitat types are in the drier areas of the unit. Their productivity for timber is lower than that of the major habitat types.

Geology

These soils are underlain by stratified glacial outwash deposits of sand and gravel.

Characteristics of the Soils

These soils have a surface layer of loess that has been influenced by volcanic ash. The surface layer is 4 to 14 inches thick. It is medium textured. The content of rounded rock fragments in the subsoil ranges from 35 to 50 percent.

Map Unit Composition

The dominant soils are loamy-skeletal, mixed, frigid Andic Dystrochrepts. They have a surface layer of loess 7 to 14 inches thick and a medium textured subsoil. The similar soils have a surface layer of loess 4 to 7 inches thick or have a coarse textured subsoil. They are loamy-skeletal, mixed, frigid Typic Dystrochrepts and sandy-skeletal, mixed, frigid Andic Udorthents. The dominant and similar soils make up about 90 percent of the unit.

Dissimilar soils make up about 10 percent of the unit. They are fine-silty, mixed, frigid Andic Dystric Eutrochrepts. They formed in lacustrine deposits. They have a subsoil and substratum of silt loam or silty clay loam. Their productivity for timber is higher than that of the dominant soils.

Representative Profile of the Soils

The dominant soils are yellowish brown gravelly silt loam in the upper 7 inches of the surface layer. The lower 13 inches of the surface layer is very pale brown very gravelly very fine sandy loam. The subsoil is strong brown very gravelly very fine sandy loam about 21 inches thick. The substratum to a depth of 60 inches or more is pale brown very cobbly coarse sand.

Management

Timber

The potential annual production is high. During site preparation stones and cobbles from the subsoil can be mixed with the soil in the surface layer. These stones and cobbles can affect planting.

Roads

Tread erosion tends to remove fine textured material from unsurfaced roads. The remaining gravel and cobbles form a rough surface.

Watershed

Erosion is a moderate hazard along skid trails and fire lines. The material exposed by road construction has a severe hazard of erosion. Sediment delivery efficiency is low.

Wildlife and fisheries

This map unit can provide habitat for whitetail deer in winter. The vegetation is commonly old growth forest. The streams generally provide spawning habitat for trout and whitefish.

Recreation and visual quality

Fishing, swimming, camping, gathering wood, and hunting are common recreational activities in areas of this map unit. Maintaining the visual quality of the unit is relatively easy.

107—Typic Xerochrepts, glacial outwash terraces

This map unit is on terraces. Elevation ranges from 2,500 to 2,700 feet. The vegetation consists of mountain grassland. The soils formed in glacial outwash deposits.

Landform

The dominant slopes on terrace surfaces have gradients of 0 to 15 percent. Terrace risers have slopes of 30 to 60 percent. The terraces have a weakly defined, dendritic drainage pattern. They are on the highest part of valleys and are not adjacent to streams and rivers.

Vegetation

The vegetation includes rough fescue, Idaho fescue, needleandthread, prairie junegrass, and a variety of forbs and low-growing shrubs.

Habitat Types

Idaho fescue/bluebunch wheatgrass, rough fescue/bluebunch wheatgrass, and rough fescue/Idaho fescue are the major habitat types. These habitat types are in about 85 percent of the unit.

Dissimilar habitat types are in about 15 percent of the unit. Douglas-fir/rough fescue and ponderosa pine/bitterbrush are on north aspects and in concave areas. They are in an open-grown forest.

Geology

These soils are underlain by stratified glacial outwash deposits of sand and gravel.

Characteristics of the Soils

These soils have a moderately coarse textured surface layer. The content of rounded rock fragments in the subsoil ranges from 35 to 50 percent.

Map Unit Composition

The dominant soils are loamy-skeletal, mixed, frigid Typic Xerochrepts. They do not have an accumulation of lime in the subsoil. The similar soils have an accumulation of lime in the subsoil. They are loamy-skeletal, mixed, frigid Calcixerollic Xerochrepts. The dominant and similar soils make up about 90 percent of the unit.

Dissimilar soils make up about 10 percent of the unit. They are fine-silty, mixed, frigid Typic Xerochrepts. They formed in lacustrine deposits. They have a subsoil and substratum of silt loam or silty clay loam. Their productivity for timber is higher than that of the dominant soils.

Representative Profile of the Soils

The dominant soils have a surface layer of dark grayish brown very gravelly sandy loam about 4 inches thick. The subsoil is white and light gray very gravelly sandy loam about 23 inches thick. The substratum to a depth of 60 inches or more is yellowish brown extremely gravelly loamy sand.

Management

Timber

This map unit contains only scattered stands of trees. It is poorly suited to woodland managed for timber.

Roads

Tread erosion tends to remove fine textured material from unsurfaced roads. The remaining gravel and cobbles form a rough surface. Material exposed during road construction is difficult to revegetate because of moisture stress.

Watershed

The material exposed by road construction has a severe hazard of erosion. Sediment delivery efficiency is low.

Wildlife and fisheries

This map unit can provide habitat for whitetail deer in winter.

Recreation and visual quality

Camping and viewing scenery are common recreational activities in areas of this map unit. Maintaining the visual quality of the unit is relatively easy.

108—Andic Dystric Eutrochrepts, lacustrine terraces-Andic Dystrochrepts, glacial outwash terraces, complex

This map unit is on terraces. Elevation ranges from 2,000 to 4,000 feet. The vegetation consists of moist, mixed forest. The soils formed in lacustrine and glacial outwash deposits.

Landform

The dominant slopes on terrace surfaces have gradients of 0 to 15 percent. Terrace risers have slopes of 30 to 60 percent. The terraces have no surface drainage channels.

Vegetation

The vegetation is a mixed forest of western hemlock, western redcedar, grand fir, western larch, Douglas-fir, and lodgepole pine. Subalpine fir and Engelmann spruce grow along drainageways. The forest understory is dominated by shrubs and forbs.

Habitat Types

Western redcedar/queencup beadlily and western hemlock/queencup beadlily are the major habitat types. Grand fir/queencup beadlily and grand fir/twinflower are similar habitat types. These habitat types are in about 85 percent of the unit.

Dissimilar habitat types are in about 15 percent of the unit. Douglas-fir/ninebark and Douglas-fir/twinflower are on the terrace risers. Their productivity for timber is lower than that of the major habitat types.

Geology

This unit is underlain by stratified glacial outwash deposits of sand and gravel and by silt loam and silty clay loam glacial lake sediments. The glacial lake sediments have thin dark layers alternating with lighter colored layers.

Characteristics of the Soils

Both of these soils have a surface layer of loess that has been influenced by volcanic ash. The surface layer is 4 to 14 inches thick. The subsoil in both soils contains rounded rock fragments. The soil properties vary with the parent material. The soils formed in lacustrine deposits have a subsoil and substratum of silt loam and very fine sandy loam. The soils formed in glacial outwash have a subsoil and substratum of very gravelly very fine sandy loam.

Map Unit Composition

The dominant soils that formed in lacustrine deposits are fine-silty, mixed, frigid Andic Dystric Eutrochrepts. They have a surface layer of loess 7 to 14 inches thick. The similar soils have a surface layer of loess 4 to 7 inches thick. They are fine-silty, mixed, frigid Dystric Eutrochrepts. These dominant and similar soils make up about 60 percent of the unit.

The dominant soils that formed in glacial outwash deposits are loamy-skeletal, mixed, frigid Andic Dystrochrepts. They have a surface layer of loess 7 to 14 inches thick. The similar soils have a surface layer of loess 4 to 7 inches thick. They are loamy-skeletal, mixed, frigid Typic Dystrochrepts. These dominant and similar soils make up about 40 percent of the unit.

The components of this unit occur in areas so intricately mixed that it was not practical to map them separately at the scale used.

Representative Profile of the Soils

The Andic Dystric Eutrochrepts have a surface layer of light yellowish brown silt loam about 9 inches thick. The upper part of the subsoil is white silt loam about 22 inches thick. The lower part is pale yellow very fine sandy loam about 26 inches thick. The substratum to a depth of 60 inches or more is white silt loam.

The Andic Dystrochrepts are yellowish brown gravelly silt loam in the upper 7 inches of the surface layer. They are very pale brown very gravelly very fine sandy loam in the lower 13 inches of the surface layer. The subsoil is strong brown very gravelly very fine sandy loam about 21 inches thick. The substratum to a depth of 60 inches or more is pale brown very fine sandy loam.

Management

Timber

The potential annual production is high. The soil in the surface layer of both soils can be displaced and the subsoil of both soils can be exposed when sites are prepared for planting and when tractors are operated on the sites. Frost heaving can damage seedlings planted in the subsoil of the Andic Dystric Eutrochrepts.

Roads

Roadcuts along the terrace risers tend to slough. The formation of ruts is a hazard in areas of the Andic Dystric Eutrochrepts if unsurfaced roads are traveled when the soils are wet. In areas of the Andic Dystrochrepts, tread erosion tends to remove fine textured material from unsurfaced roads. The remaining gravel and cobbles form a rough surface.

Watershed

The erosion hazard is severe along skid trails and fire lines and in areas where soil material has been exposed by road construction. The sediment that results from the erosion of the Andic Dystric Eutrochrepts is particularly damaging to the spawning habitat of fish. Sediment delivery efficiency is low.

Wildlife and fisheries

This map unit can provide habitat for whitetail deer in winter and habitat for elk in summer. Some areas include mineral licks for big game. The vegetation is frequently old growth forest. The streams generally provide spawning habitat for trout and whitefish.

Recreation and visual quality

Hunting, camping, and gathering wood are common recreational activities in areas of this map unit. Maintaining the visual quality of the unit is relatively easy.

109—Typic Xerochrepts, alluvial terraces

This map unit is on terraces. Elevation ranges from 2,500 to 2,700 feet. The vegetation consists of mountain grassland. The soils formed in alluvial deposits.

Landform

The dominant slopes on terrace surfaces have gradients of 0 to 15 percent. Terrace risers have slopes of 30 to 60 percent. The terraces are adjacent to rivers and streams. They have no surface drainage channels.

Vegetation

The vegetation includes rough fescue, Idaho fescue, bluebunch wheatgrass, needleandthread, prairie junegrass, and a variety of forbs and low-growing shrubs.

Habitat Types

Idaho fescue/bluebunch wheatgrass, rough fescue/bluebunch wheatgrass, and rough fescue/Idaho fescue are the major habitat types. These habitat types are in about 85 percent of the unit.

Dissimilar habitat types are in about 15 percent of the unit. Douglas-fir/rough fescue and ponderosa pine/bitterbrush are on north aspects and in concave areas. They are in an open-grown forest.

Geology

These soils are underlain by stratified alluvial deposits of sand, silt, and gravel.

Characteristics of the Soils

These soils have a moderately coarse textured surface layer. The subsoil is calcareous. The content of rounded rock fragments in the subsoil ranges from 35 to 50 percent.

Map Unit Composition

The dominant soils are loamy-skeletal, mixed, frigid Typic Xerochrepts. They do not have an accumulation of lime in the subsoil. The similar soils have an accumulation of lime in the subsoil. They are loamy-skeletal, mixed, frigid Calcixerollic Xerochrepts. The dominant and similar soils make up about 90 percent of the unit.

Dissimilar soils make up about 10 percent of the unit. They are fine-silty, mixed, frigid Typic Xerochrepts. They formed in lacustrine deposits. They have a subsoil and substratum of silt loam and silty clay loam. Their productivity for timber is higher than that of the dominant soils.

Representative Profile of the Soils

The dominant soils have a surface layer of dark grayish brown very gravelly sandy loam about 4 inches thick. The subsoil is light gray very gravelly sandy loam about 23 inches thick. The substratum to a depth of 60 inches or more is yellowish brown extremely gravelly loamy sand.

Management

Timber

This map unit contains only scattered stands of trees. It is poorly suited to woodland managed for timber.

Roads

Tread erosion tends to remove fine textured material from unsurfaced roads. The remaining gravel and cobbles form a rough surface. Material exposed during road construction is difficult to revegetate because of moisture stress.

Watershed

The major concern of watershed management is the protection of streambanks and channels. Carefully locating bridges and culverts helps to maintain the stability of the channels. Changes in the channel can result in a large amount of sediment. Disturbing the soils on or adjacent to the streambanks can result in severe sedimentation. The material exposed by road construction has a severe hazard of erosion. Sediment delivery efficiency is high.

Wildlife and fisheries

This map unit can provide habitat for whitetail deer in winter. The streams provide spawning habitat for trout and whitefish.

Recreation and visual quality

This map unit does not provide opportunities for common recreational activities. Maintaining the visual quality of the unit is relatively easy.

110—Eutrochrepts, glacial outwash terraces

This map unit is on terraces. Elevation ranges from 2,000 to 3,500 feet. The vegetation consists of moist, mixed forest. The soils formed in glacial outwash deposits that have been reworked by wind.

Landform

The dominant slopes have gradients of 0 to 15 percent, but slopes are as much as 40 percent on the sides of dunes. Terrace surfaces have been reworked by wind and are characterized by dunes that have low relief and by depressions. The terraces are adjacent to major rivers. They have no surface drainage pattern.

Vegetation

The vegetation is a mixed forest of western hemlock, western redcedar, grand fir, western larch, Douglas-fir, and lodgepole pine. The forest understory is dominated by shrubs and forbs.

Habitat Types

Western redcedar/queencup beadlily and western hemlock/queencup beadlily are the major habitat types. Grand fir/queencup beadlily and grand fir/twinflower are similar habitat types. These habitat types occupy 100 percent of the unit.

Geology

These soils are underlain by glacial outwash deposits that have been reworked by wind. The deposits are fine sand and silt.

Characteristics of the Soils

These soils have a surface layer of loess that has been influenced by volcanic ash. The surface layer is 4 to 14 inches thick. It is medium textured. The subsoil is calcareous. The content of rounded rock fragments in the subsoil ranges from 0 to 15 percent.

Map Unit Composition

The dominant soils are coarse-loamy, mixed, frigid Eutrochrepts. They make up about 90 percent of the unit.

Dissimilar soils make up about 10 percent of the unit. They are loamy-skeletal, mixed, frigid Eutrochrepts. They are near streams. They have a substratum of very gravelly loamy sand. Their productivity for timber is lower than that of the dominant soils.

Representative Profile of the Soils

The dominant soils have a surface layer of dark yellowish brown silt loam about 11 inches thick. The subsoil is calcareous, yellowish brown very fine sandy loam about 24 inches thick. The substratum to a depth of 60 inches or more is calcareous, brown very fine sandy loam.

Management

Timber

The potential annual production is high. Productivity on the site is highly dependent on the loess surface layer. If tractors are operated on the site, the loess surface layer can become compacted or be displaced or it can be mixed with subsoil material.

Roads

If unsurfaced roads are traveled when the soils are wet, the formation of ruts is a hazard.

Watershed

Erosion is a moderate hazard along skid trails and fire lines. The material exposed by road construction has a severe hazard of erosion. The sediment that results from the erosion of these soils is particularly damaging to the spawning habitat of fish. Sediment delivery efficiency is low.

Wildlife and fisheries

This map unit can provide habitat for whitetail deer, elk, and mule deer in winter. The streams generally provide spawning habitat for trout and whitefish.

Recreation and visual quality

Hunting and gathering wood are common recreational activities in areas of this map unit. Maintaining the visual quality of the unit is relatively easy; however, roadcuts are obtrusive if they are not vegetated.

111—Calcixerollic Xerochrepts, glacial outwash terraces

This map unit is on terraces. Elevation ranges from 2,500 to 2,700 feet. The vegetation consists of mountain grassland. The soils formed in glacial outwash deposits that have been reworked by wind.

Landform

The dominant slopes have gradients of 0 to 15 percent, but slopes are as much as 40 percent on the sides of dunes. Terrace surfaces have been reworked by wind and are characterized by dunes that have low relief and by depressions. The terraces are adjacent to major rivers. They have no surface drainage pattern.

Vegetation

The vegetation includes rough fescue, bluebunch wheatgrass, Idaho fescue, needleandthread, prairie junegrass, and a variety of forbs and low-growing shrubs.

Habitat Types

Idaho fescue/bluebunch wheatgrass, rough fescue/bluebunch wheatgrass, and rough fescue/Idaho fescue are the major habitat types. These habitat types are in about 85 percent of the unit.

Dissimilar habitat types are in about 15 percent of the unit. Douglas-fir/rough fescue and ponderosa pine/bitterbrush are adjacent to the shoreline of the Koocanusa Reservoir. They are in an open-grown forest.

Geology

These soils are underlain by glacial outwash deposits that have been reworked by wind. The deposits are fine sand and silt.

Characteristics of the Soils

These soils have a moderately coarse textured surface layer. The content of rounded rock fragments in the subsoil ranges from 0 to 10 percent. The subsoil is calcareous.

Map Unit Composition

The dominant soils are coarse-loamy, mixed, frigid Calcixerollic Xerochrepts. They make up about 90 percent of the unit.

Dissimilar soils make up about 10 percent of the unit. They are loamy-skeletal, mixed, frigid Typic Xerochrepts. They are along streams. They have a very gravelly substratum.

Representative Profile of the Soils

The dominant soils have a surface layer of light yellowish brown very fine sandy loam about 8 inches thick. The upper part of the subsoil is calcareous, pale brown loamy very fine sand about 12 inches thick. The lower part to a depth of 60 inches or more is calcareous, light gray and pale brown very fine sandy loam and loamy fine sand.

Management

Timber

This map unit contains only scattered stands of trees. It is poorly suited to woodland managed for timber.

Roads

If unsurfaced roads are traveled when the soils are wet, the formation of ruts is a hazard. Revegetation is limited by a lack of rainfall in summer. The species selected for planting should be those that can tolerate the drought in summer.

Watershed

The material exposed by road construction has a severe hazard of erosion. The sediment that results from the erosion of these soils is particularly damaging to the spawning habitat of fish. Sediment delivery efficiency is low.

Wildlife and fisheries

This map unit can provide habitat for deer, elk, and mule deer in winter. The streams generally provide spawning habitat for trout.

Recreation and visual quality

This unit is adjacent to Koocanusa Reservoir. It is suited to camp areas, boat launching areas, and similar kinds of recreational site development. Maintaining the visual quality of the unit is relatively easy.

112—Eutric Glossoboralfs, lacustrine terraces

This map unit is on terraces. Elevation ranges from 2,200 to 3,600 feet. The vegetation consists of moist, mixed forest. The soils formed in lacustrine deposits.

Landform

The dominant slopes have gradients of 0 to 25 percent. The terraces were formed by the fluctuating levels of Lake Missoulaab. They are on valley side slopes, mainly along the Clark Fork River and its tributaries, and have a hummocky appearance with evidence of many small slumps. Small ponds are in depressions created by these slumps. Springs are throughout the map unit. The terraces have a dendritic drainage pattern. Terrace risers are steep and have deeply incised drainageways.

Vegetation

The vegetation is a mixed forest of western hemlock, western redcedar, grand fir, Douglas-fir, western white pine, Engelmann spruce, western larch, and lodgepole pine. The forest understory is dominated by shrubs and forbs.

Habitat Types

Western hemlock/queencup beadlily and western redcedar/queencup beadlily are the major habitat types. Grand fir/queencup beadlily is a similar habitat type. These habitat types are in about 85 percent of the unit.

Dissimilar habitat types are in about 15 percent of the unit. Douglas-fir/ninebark and Douglas-fir/snowberry are on south aspects. Their productivity for timber is lower than that of the major habitat types.

Geology

These soils are underlain by silt loam and silty clay loam glacial lake sediments. They have thin layers of dark sediments alternating with lighter colored layers.

Characteristics of the Soils

These soils have a medium or moderately fine textured surface layer. In places the surface layer is loess that has been influenced by volcanic ash. This surface layer, if it occurs, is as much as 14 inches thick. The subsoil and substratum are silty clay loam and silty clay. The content of rounded rock fragments in the subsoil and substratum ranges from 0 to 10 percent.

Map Unit Composition

The dominant soils are fine, illitic Eutric Glossoboralfs. They make up about 85 percent of the unit.

Dissimilar soils make up about 15 percent of the unit. They are fine, illitic, frigid Andaqueptic Ochraqualfs and loamy-skeletal, mixed, frigid Andic Dystrochrepts. The Andaqueptic Ochraqualfs are in depressions and around seeps and springs. They are poorly drained. The Andic Dystrochrepts are along drainageways. They have a very gravelly subsoil and substratum.

Representative Profile of the Soils

The dominant soils have a surface layer of brown silty clay loam about 9 inches thick. The upper part of the subsoil is dark yellowish brown silty clay about 9 inches thick. The lower part is brown silty clay about 12 inches thick. The substratum to a depth of 60 inches or more is brown silty clay.

Management

Timber

The potential annual production is high. The soil in the surface layer can be displaced and the subsoil exposed when sites are prepared for planting and when tractors are operated on the sites. Frost heaving can damage seedlings that are planted in the subsoil.

Roads

Roadcuts along the terrace risers tend to slough. If unsurfaced roads are traveled when the soils are wet, the formation of ruts is a hazard. Surface crusting limits revegetation in areas where the substratum has been exposed during construction. Seeding these areas as soon as possible after construction helps to ensure successful revegetation.

Watershed

Erosion is a moderate hazard along skid trails and fire lines. The material exposed by road construction has a severe hazard of erosion. The sediment that results from the erosion of these soils is particularly damaging to the spawning habitat of fish. Sediment delivery efficiency is low.

Wildlife and fisheries

This map unit can provide important habitat for big game in late spring and early summer. The vegetation is commonly old growth forest. The streams generally provide spawning habitat for trout.

Recreation and visual quality

Fishing and viewing wildlife are common recreational activities in areas of this map unit. Maintaining the visual quality of the unit is difficult. Roadcuts are obtrusive because the material exposed by sloughing is difficult to revegetate.

114—Typic Xerochrepts, lacustrine terraces

This map unit is on terraces. Elevation ranges from 2,500 to 2,700 feet. The vegetation consists of mountain grassland. The soils formed in lacustrine deposits.

Landform

The dominant slopes on terrace surfaces have gradients of 0 to 15 percent. Terrace risers have slopes of 30 to 60 percent. The terraces have a dendritic drainage pattern. The terrace risers have short, deeply incised drainageways.

Vegetation

The vegetation includes rough fescue, bluebunch wheatgrass, Idaho fescue, needleandthread, prairie junegrass, and a variety of forbs and low-growing shrubs.

Habitat Types

Idaho fescue/bluebunch wheatgrass, rough fescue/bluebunch wheatgrass, and rough fescue/Idaho fescue are the major habitat types. These habitat types are in about 85 percent of the unit.

Dissimilar habitat types are in about 15 percent of the unit. Douglas-fir/rough fescue and ponderosa pine/bitterbrush are adjacent to the shoreline of Koocanusa Reservoir. They are in an open-grown forest.

Geology

These soils are underlain by silt loam and silty clay loam glacial lake sediments. They have thin layers of dark sediments alternating with lighter colored layers.

Characteristics of the Soils

These soils have a medium textured surface layer. The content of rounded rock fragments in the subsoil ranges from 0 to 10 percent.

Map Unit Composition

The dominant soils are fine-silty, mixed, frigid Typic Xerochrepts. They do not have an accumulation of clay in the subsoil. The similar soils have an accumulation of clay in the subsoil. They are fine-silty, mixed Eutric Glossoboralfs. The dominant and similar soils make up about 90 percent of the unit.

Dissimilar soils make up about 10 percent of the unit. They are loamy-skeletal, mixed, frigid Typic Xerochrepts. They formed in glacial outwash deposits. They have a very gravelly subsoil and substratum.

Representative Profile of the Soils

The dominant soils have a surface layer of dark brown and brown silt loam about 10 inches thick. The subsoil is light gray, white, and light yellowish brown silt loam about 39 inches thick. The substratum to a depth of 60 inches or more is light gray silt.

Management

Timber

This map unit contains only scattered stands of trees. It is poorly suited to woodland managed for timber.

Roads

If unsurfaced roads are traveled when the soils are wet, the formation of ruts is a hazard. Revegetation is limited by a lack of rainfall in the summer. The species selected for planting should be those that can withstand the drought in summer. Surface crusting limits revegetation in areas where the substratum has been exposed during road construction. Seeding these areas as soon as possible after construction improves revegetation.

Watershed

Erosion is a severe hazard along fire lines and in areas where soil material has been exposed by road construction. The sediment that results from the erosion of these soils is particularly damaging to the spawning habitat of fish. Sediment delivery efficiency is low.

Wildlife and fisheries

This map unit can provide habitat for whitetail deer in winter. It commonly includes mineral licks for big game. The streams generally provide spawning habitat for trout.

Recreation and visual quality

This unit is adjacent to Koocanusa Reservoir. It is suited to camp areas, boat launching areas, and similar kinds of recreational site development. Maintaining the visual quality of the unit is relatively easy; however, roadcuts are obtrusive if they are not vegetated.

201—Rock outcrop-Lithic Ustochrepts-Typic Ustochrepts complex, breaklands

This map unit is on breaklands. Elevation ranges from 2,400 to 4,800 feet. The vegetation consists of dry, mixed forest. The soils formed in material weathered from metasedimentary rocks.

Landform

The dominant slopes are on southerly aspects and have gradients of 60 to 80 percent. The breaklands are adjacent to valley bottoms along streams. The slopes commonly include ledges and benches formed by layers of bedrock. The drainage pattern is parallel to dendritic. The drainage channels are widely spaced.

Vegetation

The vegetation is a mixed forest of Douglas-fir and ponderosa pine with an understory dominated by shrubs. The Douglas-fir and ponderosa pine are in scattered areas on ledges and in crevasses of the Rock outcrop.

Habitat Types

Douglas-fir/ninebark is the major habitat type in forested areas. It occupies about 35 percent of the unit. Barren rock, talus, and forested scree communities occupy about 65 percent of the unit.

Geology

This map unit is underlain by argillite, siltite, and quartzite of the Belt supergroup. These rocks produce medium textured and moderately coarse textured material when weathered.

Characteristics of the Soils

The soils in this map unit have a moderately coarse textured surface layer. The content of angular rock fragments in their subsoil ranges from 50 to 70 percent. The soils are not easily identified by unique landscape features. They are either 4 to 20 inches deep over bedrock or 20 to 40 inches deep over bedrock.

Map Unit Composition

The Rock outcrop is in areas throughout the map unit. Rubble land, which is similar to Rock outcrop, is also included. The Rock outcrop and rubble land make up about 50 percent of the unit.

The dominant soils are loamy-skeletal, mixed, frigid Lithic Ustochrepts and loamy-skeletal, mixed, frigid Typic Ustochrepts. The Lithic Ustochrepts are 4 to 20 inches deep over bedrock. They make up about 30 percent of the unit. The Typic Ustochrepts are 20 to 40 inches deep over bedrock. They make up about 20 percent of the unit.

The components of this unit occur in areas so intricately mixed that it was not practical to map them separately at the scale used.

Representative Profile of the Soils

The Lithic Ustochrepts have a surface layer of brown very cobbly sandy loam about 6 inches thick. The upper part of the subsoil is light yellowish brown very cobbly sandy loam about 6 inches thick. The lower part is light brownish gray extremely cobbly fine sandy loam. Bedrock is at a depth of about 19 inches.

The Typic Ustochrepts have a surface layer of dark gray very gravelly very fine sandy loam about 8 inches thick. The subsoil is gray extremely gravelly very fine sandy loam about 19 inches thick. The substratum is gray extremely gravelly very fine sandy loam. Bedrock is at a depth of about 45 inches.

Management

Timber

This map unit contains only scattered stands of trees. It is poorly suited to woodland managed for timber.

Roads

The slope increases the amount of material that is excavated during road construction. The hard rock frequently limits excavation. If the hard rock is excavated, the cut and fill material is extremely stony and has a low water-holding capacity. Unsurfaced roads are rough because of large stones or cobbles. Large stones can roll from roadcuts onto road surfaces causing a driving hazard. Material exposed during road construction is difficult to revegetate because of moisture stress.

Watershed

The soil material exposed by road construction has a slight hazard of erosion. Sediment delivery efficiency is high.

Wildlife and fisheries

This map unit can provide habitat for bighorn sheep in spring and commonly provides important habitat for lambing. It can provide important habitat for mule deer and elk in winter.

Recreation and visual quality

Viewing and photographing wildlife and wild flowers are common recreational activities in areas of this map unit. Maintaining the visual quality of the unit is difficult because of the slope and sparse forest cover.

251—Andic Dystrochrepts-Rock outcrop complex, breaklands

This map unit is on breaklands. Elevation ranges from 2,500 to 5,000 feet. The vegetation consists of dry, mixed forest and moist, mixed forest. The soils formed in material weathered from metasedimentary rocks.

Landform

The dominant slopes are on northerly aspects and have gradients of 60 to 80 percent. The breaklands are adjacent to valley bottoms along streams. The drainage

pattern is parallel to dendritic. The drainage channels are steep and widely spaced.

Vegetation

The vegetation is a mixed forest of western larch, western hemlock, Douglas-fir, ponderosa pine, western white pine, grand fir, and lodgepole pine. The forest understory is dominated by shrubs and forbs.

Habitat Types

Habitat types vary in this map unit depending on location. In the Cabinet Range and the western part of the Purcell Range, the major habitat types are western redcedar/queencup beadlily and western hemlock/queencup beadlily. Grand fir/twinflower is a similar habitat type. In the Salish Range and the eastern part of the Purcell Range, the major habitat type is Douglas-fir/ninebark. Douglas-fir/twinflower is a similar habitat type. These habitat types are in about 85 percent of the forested part of the unit.

Dissimilar habitat types are in about 15 percent of the forested part of the unit. Douglas-fir/twinflower and Douglas-fir/ninebark are on northwest-facing slopes. Their productivity for timber is lower than that of the major habitat types.

Geology

This map unit is underlain by argillite, siltite, and quartzite of the Belt supergroup. These rocks produce medium textured and moderately coarse textured material when weathered.

Characteristics of the Soils

The soils in this map unit have a surface layer of loess that has been influenced by volcanic ash. The surface layer is 4 to 14 inches thick. It is medium textured. The content of angular rock fragments in the subsoil ranges from 50 to 70 percent.

Map Unit Composition

The dominant soils are loamy-skeletal, mixed, frigid Andic Dystrochrepts. They have a surface layer of loess 7 to 14 inches thick. The similar soils have a surface layer of loess 4 to 7 inches thick. They are loamy-skeletal, mixed, frigid Typic Dystrochrepts. The dominant and similar soils make up about 50 percent of the unit.

The Rock outcrop is in areas throughout the map unit. It makes up about 40 percent of the unit.

The components of this unit occur in areas so intricately mixed that it was not practical to map them separately at the scale used.

Dissimilar soils make up about 10 percent of the unit. They are loamy-skeletal, mixed, frigid Lithic Dystrochrepts. They are in areas near the Rock outcrop. They are 4 to 20 inches deep over bedrock. Their productivity for timber is lower than that of the dominant soils.

Representative Profile of the Soils

The dominant soils are yellowish brown gravelly silt loam in the upper 7 inches of the surface layer. They are very pale brown very gravelly very fine sandy loam in the lower 13 inches of the surface layer. The subsoil is strong brown very gravelly very fine sandy loam about 21 inches thick. The substratum to a depth of 60 inches or more is pale brown extremely gravelly very fine sandy loam.

Management

Timber

The potential annual production is high in forested areas. Productivity in the map unit is limited by the Rock outcrop. The slope severely limits the operation of tractors. Cable logging systems are safer and disturb the soil less than tractor logging systems.

Roads

The slope increases the amount of material that is excavated during road construction. The hard rock frequently limits excavation. If the hard rock is excavated, the cut and fill material is extremely stony and has a low water-holding capacity. Unsurfaced roads are rough because of large stones or cobbles. Large stones can roll from roadcuts onto road surfaces causing a driving hazard. Material exposed during road construction is difficult to revegetate because of moisture stress.

Watershed

Erosion is a moderate hazard along skid trails and fire lines. The material exposed by road construction has a slight hazard of erosion. Sediment delivery efficiency is high.

Wildlife and fisheries

This map unit can provide habitat for big game in summer. The vegetation is commonly old growth forest that includes snags suitable for use as cavity nesting habitat.

Recreation and visual quality

Viewing wildlife is a common recreational use. Maintaining the visual quality of the unit is difficult because roadcuts on steep slopes are obtrusive if they are not vegetated.

252—Andic Dystrochrepts, breaklands

This map unit is on breaklands. Elevation ranges from 3,100 to 5,000 feet. The vegetation consists of

moist, mixed forest. The soils formed in material weathered from metasedimentary rocks.

Landform

The dominant slopes are on northerly aspects and have gradients of 60 to 80 percent. The breaklands are adjacent to valley bottoms along streams. The drainage pattern is parallel to weakly dendritic. The drainage channels are steep and closely spaced.

Vegetation

The vegetation is a mixed forest of western hemlock, western larch, grand fir, Douglas-fir, lodgepole pine, and subalpine fir. The forest understory is dominated by shrubs and forbs.

Habitat Types

Western hemlock/queencup beadlily is the major habitat type. Grand fir/queencup beadlily and subalpine fir/queencup beadlily are similar habitat types. These habitat types are in about 85 percent of the unit.

Dissimilar habitat types are in about 15 percent of the unit. Subalpine fir/beargrass is at the higher elevations, and Douglas-fir/ninebark is at the lower elevations. Their productivity for timber is lower than that of the major habitat type.

Geology

These soils are underlain by argillite, siltite, and quartzite of the Belt supergroup. These rocks produce medium textured and moderately coarse textured material when weathered.

Characteristics of the Soils

These soils have a surface layer of loess that has been influenced by volcanic ash. The surface layer is 4 to 14 inches thick. It is medium textured. The content of angular rock fragments in the subsoil ranges from 50 to 70 percent.

Map Unit Composition

The dominant soils are loamy-skeletal, mixed, frigid Andic Dystrochrepts. They have a surface layer of loess 7 to 14 inches thick and a moderately coarse textured subsoil. The similar soils have a surface layer of loess 4 to 7 inches thick or a coarse textured subsoil. They are loamy-skeletal, mixed, frigid Typic Dystrochrepts and sandy-skeletal, mixed, frigid Andic Udorthents. The dominant and similar soils make up about 80 percent of the unit.

Rock outcrop and dissimilar soils make up about 20 percent of the unit. They are on the upper slopes. The dissimilar soils are loamy-skeletal, mixed, frigid Lithic Dystrochrepts. They are 4 to 20 inches deep over bedrock. Their productivity for timber is lower than that of the dominant soils.

Representative Profile of the Soils

The dominant soils are yellowish brown gravelly silt loam in the upper 7 inches of the surface layer. They are very pale brown very gravelly very fine sandy loam in the lower 13 inches of the surface layer. The subsoil is strong brown very gravelly very fine sandy loam about 21 inches thick. The substratum to a depth of 60 inches or more is pale brown extremely gravelly very fine sandy loam.

Management

Timber

The potential annual production is high. The slope severely limits the operation of tractors. Cable logging systems are safer and disturb the soil less than tractor logging systems.

Roads

The slope increases the amount of material that is excavated during road construction. Unsurfaced roads are rough because of large stones or cobbles. Large stones can roll from roadcuts onto road surfaces causing a driving hazard. Material exposed during road construction is difficult to revegetate because of moisture stress.

Watershed

Erosion is a moderate hazard along skid trails and fire lines. The material exposed by road construction has a slight hazard of erosion. Sediment delivery efficiency is high.

Wildlife and fisheries

This map unit can provide habitat for big game in summer. The vegetation frequently is old growth forest that includes snags suitable for use as cavity nesting habitat.

Recreation and visual quality

Hunting and picking berries are occasional recreational activities in areas of this map unit. Maintaining the visual quality of the unit is difficult because roadcuts on steep slopes are obtrusive if they are not vegetated.

301—Dystric Eutrochrepts, glaciated mountain slopes

This map unit is on glaciated mountain slopes. Elevation ranges from 2,400 to 3,800 feet. The vegetation consists of dry, mixed forest. The soils formed in compact glacial till.

Landform

The dominant slopes are on southerly aspects and have gradients of 15 to 35 percent. The glaciated

mountain slopes are mantled with glacial till. The drainage pattern is dendritic. The drainageways are widely spaced and moderately entrenched.

Vegetation

The vegetation is a mixed forest of Douglas-fir, ponderosa pine, western larch, and lodgepole pine. The forest understory is dominated by shrubs.

Habitat Types

Douglas-fir/snowberry is the major habitat type. Douglas-fir/ninebark, Douglas-fir/twinflower, and Douglas-fir/pinegrass are similar habitat types. These habitat types are in about 85 percent of the unit.

Dissimilar habitat types are in about 15 percent of the unit. Engelmann spruce and subalpine fir habitat types are in valley bottoms. Their productivity for timber is higher than that of the major habitat type.

Geology

These soils are underlain by dense, brittle glacial till.

Characteristics of the Soils

These soils have a medium textured surface layer. The content of rounded rock fragments in the subsoil ranges from 20 to 50 percent. The substratum is dense and brittle when moist.

Map Unit Composition

The dominant soils are loamy-skeletal, mixed, frigid Dystric Eutrochrepts. The content of rock fragments in their subsoil ranges from 35 to 50 percent. The similar soils are coarse-loamy, mixed, frigid Dystric Eutrochrepts. The content of rock fragments in their subsoil ranges from 20 to 35 percent. The dominant and similar soils make up 100 percent of the map unit.

Representative Profile of the Soils

The dominant soils have a surface layer of brown and white gravelly silt loam about 11 inches thick. The subsoil is light gray very gravelly fine sandy loam about 28 inches thick. The substratum to a depth of 60 inches or more is dense, brittle, light gray very gravelly fine sandy loam and loamy sand.

Management

Timber

The potential annual production is moderate. Insolation limits productivity. The terrain is well suited to the operation of tractors. Rotting wood is an important source of nitrogen in this unit. Leaving large diameter slash on the site after logging helps to maintain fertility. Trees are susceptible to windthrow because the dense, brittle substratum restricts root penetration.

Roads

Material exposed during road construction tends to slough. Tread erosion tends to remove fine textured material from unsurfaced roads. The remaining gravel and cobbles form a rough surface. Surface crusting limits revegetation in areas where the substratum has been exposed during construction and where there is a lack of rainfall in summer. Seeding these areas as soon as possible after construction with species that can withstand the drought in summer helps to ensure successful revegetation.

Watershed

The hazard of erosion is moderate along skid trails and fire lines and in areas where soil material has been exposed by road construction. Sediment delivery efficiency is moderate.

Wildlife and fisheries

This map unit can provide habitat for mule deer, elk, and whitetail deer in winter. It is at the lower elevations where the depth of snow seldom limits access to food sources. It commonly supports snags suitable for cavity habitat. It can include mineral licks for big game. The streams provide spawning habitat for trout.

Recreation and visual quality

Driving for pleasure, hunting, and gathering wood are common recreational activities in areas of this map unit. Maintaining the visual quality of the unit is moderately difficult because revegetating the material exposed in roadcuts is difficult.

302—Typic Ustochrepts, glaciated mountain slopes, steep

This map unit is on glaciated mountain slopes. Elevation ranges from 3,000 to 4,200 feet. The vegetation consists of dry, mixed forest. The soils formed in compact glacial till.

Landform

The dominant slopes are on southerly aspects and have gradients of 30 to 60 percent. The glaciated mountain slopes are mantled with glacial till. They are in areas below glacially scoured, convex ridges and above concave side slopes. The drainage pattern is dendritic. The drainageways are widely spaced.

Vegetation

The vegetation is old growth stands of Douglas-fir mixed with ponderosa pine. Western larch and lodgepole pine are along draws and at the higher elevations. The forest understory is dominated by shrubs.

Habitat Types

Douglas-fir/snowberry is the major habitat type. Douglas-fir/ninebark, Douglas-fir/pinegrass, Douglas-fir/kinnikinnick, Douglas-fir/twinflower, and Douglas-fir/dwarf huckleberry are similar habitat types. These habitat types are in 100 percent of the unit.

Geology

These soils are underlain by dense, brittle glacial till.

Characteristics of the Soils

These soils have a medium textured surface layer. The content of rounded rock fragments in the subsoil ranges from 20 to 50 percent. The substratum is dense and brittle when moist.

Map Unit Composition

The dominant soils are loamy-skeletal, mixed, frigid Typic Ustochrepts. The content of rock fragments in their subsoil ranges from 35 to 50 percent. The similar soils are coarse-loamy, mixed, frigid Dystric Eutrochrepts. The content of rock fragments in their subsoil ranges from 20 to 35 percent. The dominant and similar soils make up about 80 percent of the unit.

Rock outcrop and dissimilar soils make up about 20 percent of the unit. They are in areas throughout the map unit. The dissimilar soils are loamy-skeletal, mixed, frigid Lithic Ustochrepts. They are 4 to 20 inches deep over bedrock. Their productivity for timber is lower than that of the dominant soils.

Representative Profile of the Soils

The dominant soils have a surface layer of dark gray very gravelly very fine sandy loam about 8 inches thick. The subsoil is gray very gravelly very fine sandy loam about 19 inches thick. The substratum to a depth of 45 inches or more is dense, brittle, gray very gravelly very fine sandy loam.

Management

Timber

The potential annual production is moderate. Insolation limits productivity. The slope limits the operation of tractors. Rotting wood is an important source of nitrogen in this unit. Leaving large diameter slash on the site after logging helps to maintain fertility. Trees are susceptible to windthrow because the dense, brittle substratum restricts root penetration.

Roads

Material exposed in cutbanks during road construction tends to slough if the cutbanks are steep. Tread erosion tends to remove fine textured material from unsurfaced roads. The remaining gravel and cobbles form a rough surface. Surface crusting limits revegetation in areas where the substratum has been exposed during construction and where there is a lack of rainfall in summer. Seeding these areas as soon as possible after construction with species that can withstand the drought in summer helps to ensure successful revegetation.

Watershed

The hazard of erosion is moderate along skid trails and fire lines and in areas where soil material has been exposed by road construction. Sediment delivery efficiency is moderate.

Wildlife and fisheries

This map unit can provide good habitat for mule deer and elk in winter. It is at the lower elevations where the depth of snow seldom limits access to food sources.

Recreation and visual quality

Hunting and gathering wood are common recreational activities in areas of this map unit. Maintaining the visual quality of the unit is difficult because of the slope and the difficulty in revegetating the soil material exposed in roadcuts.

303—Rock outcrop-Lithic Ustochrepts complex, glaciated mountain ridges

This map unit is on glaciated mountain ridges. Elevation ranges from 3,500 to 4,700 feet. The vegetation consists of open-grown forest. The soils formed mostly in material weathered from metasedimentary rocks.

Landform

The dominant slopes are on southerly aspects and have gradients of 15 to 35 percent. The glaciated mountain ridges are rounded because of glacial scouring. There is no surface drainage system.

Vegetation

The vegetation is stunted Douglas-fir and lodgepole pine forest interspersed with grassland. The forest understory is dominated by bunchgrasses mixed with shrubs and forbs.

Habitat Types

Douglas-fir/bluebunch wheatgrass is the major habitat type. This habitat type occupies about 85 percent of the forested part of the unit.

Douglas-fir/pinegrass, which is a dissimilar habitat type, is in about 15 percent of the forested part of the unit. It is on northerly aspects. Its productivity for timber is higher than that of the major habitat type.

Geology

This map unit is underlain by argillite, siltite, and

quartzite of the Belt supergroup. Thin deposits of dense, brittle glacial till overlie the bedrock in places.

Characteristics of the Soils

The soils in this map unit are 4 to 20 inches deep over bedrock. They have a moderately coarse textured surface layer. The content of rounded rock fragments in their subsoil ranges from 50 to 70 percent.

Map Unit Composition

The Rock outcrop is in areas throughout the map unit. It makes up about 50 percent of the unit.

The dominant soils are loamy-skeletal, mixed, frigid Lithic Ustochrepts. They make up about 40 percent of the unit.

The components of this unit occur in areas so intricately mixed that it was not practical to map them separately at the scale used.

Dissimilar soils make up about 10 percent of the unit. They are loamy-skeletal, mixed, frigid Udic Ustochrepts. They are on the concave, lower slopes. They are 20 to 40 inches deep over bedrock. Their productivity for timber is higher than that of the dominant soils.

Representative Profile of the Soils

The dominant soils have a surface layer of brown very cobbly sandy loam about 6 inches thick. The upper part of the subsoil is light yellowish brown very cobbly sandy loam about 6 inches thick. The lower part is light brownish gray extremely cobbly fine sandy loam. Bedrock is at a depth of about 19 inches.

Management

Timber

The potential annual production is very low in forested areas. The productivity is limited by the shallow depth of the soils and solar insolation. The productivity in the map unit is limited by the Rock outcrop. The Rock outcrop also limits the operation of tractors. Trees growing on shallow soils are susceptible to windthrow.

Roads

The hard rock frequently limits excavation during road construction. If the hard rock is excavated, the cut and fill material is extremely stony and has a low water-holding capacity. Unsurfaced roads are rough because of large stones or cobbles. Material exposed during road construction is difficult to revegetate because of moisture stress.

Watershed

No special watershed protection measures are needed for the management practices that are commonly applied in this map unit.

Wildlife and fisheries

This map unit can provide habitat for bighorn sheep and habitat for lambing. It also can provide habitat for other big game animals in spring.

Recreation and visual quality

Viewing wildlife, wild flowers, and geologic formations is a common recreational activity in areas of this map unit. Areas of this unit are used as scenic overlooks. Maintaining the visual quality of the unit is difficult because the forest cover is sparse and because revegetating roadcuts is difficult.

321—Typic Eutroboralfs, drumlins

This map unit is on drumlins and moraines. Elevation ranges from 2,500 to 3,800 feet. The vegetation consists of dry, mixed forest. The soils formed in calcareous, compact glacial till.

Landform

The dominant slopes have gradients of 10 to 40 percent. The drumlins are smooth, rounded, elongated hills. They do not have surface drainageways. The moraines are rolling or hilly deposits of glacial till. They have a deranged drainage pattern.

Vegetation

The vegetation is a mixed forest of Douglas-fir, western larch, and lodgepole pine. The forest understory is dominated by pinegrass and low-growing shrubs.

Habitat Types

Douglas-fir/pinegrass is the major habitat type. Douglas-fir/ninebark, Douglas-fir/snowberry, and Douglas-fir/twinflower are similar habitat types. These habitat types are in about 90 percent of the unit.

Subalpine fir/twinflower, which is a dissimilar habitat type, is in about 10 percent of the unit. It is in depressions. Its productivity for timber is higher than that of the major habitat type.

Geology

These soils are underlain by calcareous glacial till.

Characteristics of the Soils

These soils have a medium textured surface layer. The content of rounded rock fragments in the subsoil ranges from 20 to 50 percent. The lower part of the subsoil is calcareous.

Map Unit Composition

The dominant soils are loamy-skeletal, mixed Typic Eutroboralfs. The content of rock fragments in their subsoil is 35 to 50 percent. The similar soils are fine-loamy, mixed Typic Eutroboralfs. The content of rock fragments in their subsoil is 20 to 35 percent. The

dominant and similar soils make up about 90 percent of the unit.

Dissimilar soils make up about 10 percent of the unit. They are fine-silty, mixed Typic Eutroboralfs. They do not have rock fragments in the subsoil. They are in depressions. Their subsoil and substratum have low strength and are silty clay loam.

Representative Profile of the Soils

The dominant soils are light brownish gray gravelly silt loam in the upper 2 inches of the surface layer. The lower 6 inches of the surface layer is pale brown gravelly loam. The upper part of the subsoil is yellowish brown very gravelly clay loam about 14 inches thick. The lower part to a depth of 60 inches or more is calcareous, yellowish brown very gravelly loam.

Management

Timber

The potential annual production is moderate. The terrain is well suited to the operation of tractors. Regeneration of the forest is limited by plant competition. Pinegrass competes vigorously with tree seedlings in open areas. Rotting wood is an important source of nitrogen in this unit. Leaving large diameter slash on the site after logging helps to maintain fertility. Trees are susceptible to windthrow because a dense, brittle layer in the subsoil restricts root penetration.

Roads

Material exposed in cutbanks during road construction tends to slough if the cutbanks are steep. Tread erosion tends to remove fine textured material from unsurfaced roads. The remaining gravel and cobbles form a rough surface. Surface crusting limits revegetation in areas where the lower part of the subsoil has been exposed during construction. Seeding these areas as soon as possible after construction helps to ensure successful revegetation.

Watershed

The hazard of erosion is moderate along skid trails and fire lines and in areas where soil material has been exposed by road construction. Sediment delivery efficiency is low.

Wildlife and fisheries

This map unit can provide habitat for whitetail deer throughout the year. It can include mineral licks for big game.

Recreation and visual quality

Gathering wood and viewing the drumlin landscape are common recreational activities in areas of this map unit. Roadcuts are noticeable because the exposed soil material is difficult to revegetate.

322—Eutric Glossoboralfs, moraines

This map unit is on moraines. Elevation ranges from 2,500 to 5,000 feet. The vegetation consists of moist, mixed forest. The soils formed in compact glacial till.

Landform

The dominant slopes have gradients of 15 to 35 percent. The moraines are rolling or hilly deposits of glacial till. They have a deranged drainage pattern.

Vegetation

The vegetation is a mixed forest of western larch, Douglas-fir, and lodgepole pine. Western hemlock, western redcedar, and western white pine are included in areas on the Cabinet Range and the western part of the Purcell Range. Subalpine fir is included in areas on the Salish Range and the eastern part of the Purcell Range. The forest understory is dominated by low-growing shrubs and forbs.

Habitat Types

Habitat types vary in this map unit depending on location. In the Cabinet Range and the western part of the Purcell Range, western hemlock/queencup beadlily and western redcedar/queencup beadlily are the major habitat types. In the Salish Range and the eastern part of the Purcell Range, subalpine fir/queencup beadlily is the major habitat type. These habitat types are in about 85 percent of the unit.

Douglas-fir/twinflower, which is a dissimilar habitat type, is in about 15 percent of the unit. It is at the lower elevations on southerly aspects in the Salish Range and the eastern part of the Purcell Range. Its productivity for timber is lower than that of the major habitat types.

Geology

These soils are underlain by dense, brittle glacial till.

Characteristics of the Soils

These soils have a surface layer of loess that has been influenced by volcanic ash. The surface layer is 4 to 14 inches thick. It is medium textured. The content of rounded rock fragments in the subsoil ranges from 20 to 50 percent. The substratum is dense and brittle when moist.

Map Unit Composition

The dominant soils are fine, mixed Eutric Glossoboralfs. They have a moderately fine textured subsoil. The content of rock fragments in the subsoil ranges from 20 to 35 percent. The similar soils are fine-loamy, mixed, frigid Andic Dystric Eutrochrepts and clayey-skeletal, mixed Eutric Glossoboralfs. They have a medium textured subsoil. The content of rock fragments in the subsoil ranges from 35 to 50 percent.

The dominant and similar soils make up 100 percent of the map unit.

Representative Profile of the Soils

The dominant soils have a surface layer of light yellowish brown and light gray gravelly silt loam about 18 inches thick. The subsoil is very pale brown gravelly clay loam about 10 inches thick. The substratum to a depth of 60 inches or more is dense, brittle, yellowish brown gravelly clay loam.

Management

Timber

The potential annual production is high. Productivity on the site is highly dependent on the loess surface layer. If tractors are operated on the site, productivity can be lowered because the loess surface layer can become compacted or be displaced or it can be mixed with subsoil material. Trees are susceptible to windthrow because the dense, brittle substratum restricts root penetration.

Roads

Material exposed in cutbanks during road construction tends to slough if the cutbanks are steep. If unsurfaced roads are traveled when the soils are wet, the formation of ruts is a hazard. Surface crusting limits revegetation in areas where the substratum has been exposed during construction. Seeding these areas as soon as possible after construction helps to ensure successful revegetation.

Watershed

Erosion is a moderate hazard along skid trails and fire lines. The material exposed by road construction has a severe hazard of erosion. Sediment delivery efficiency is low.

Wildlife and fisheries

This map unit can provide habitat for elk and deer in summer. The vegetation is commonly old growth forest that includes snags suitable for use as cavity nesting habitat.

Recreation and visual quality

Driving for pleasure, gathering wood, and picking berries are common recreational activities in areas of this map unit. Maintaining the visual quality of the unit is relatively easy.

323—Typic Eutroboralfs, moraines

This map unit is on moraines. Elevation ranges from 2,500 to 5,000 feet. The vegetation consists of dry, mixed forest. The soils formed in calcareous, compact glacial till.

Landform

The dominant slopes have gradients of 15 to 35 percent. The moraines are rolling or hilly deposits of glacial till. They have a deranged drainage pattern. Some of the moraines are drumlins.

Vegetation

The vegetation is a mixed forest of Douglas-fir, western larch, and lodgepole pine. The forest understory is pinegrass and low-growing shrubs.

Habitat Types

Douglas-fir/pinegrass is the major habitat type. Douglas-fir/twinflower and Douglas-fir/snowberry are similar habitat types. These habitat types are in about 85 percent of the unit.

Dissimilar habitat types are in about 15 percent of the unit. Subalpine fir/queencup beadlily and subalpine fir/twinflower are at the higher elevations or in depressions. Their productivity for timber is higher than that of the major habitat type.

Geology

These soils are underlain by calcareous glacial till.

Characteristics of the Soils

These soils have a medium textured surface layer. The content of rounded rock fragments in the subsoil ranges from 20 to 50 percent. The lower part of the subsoil is calcareous. In places the soils have a surface layer of loess that has been influenced by volcanic ash.

Map Unit Composition

The dominant soils are fine-loamy, mixed Typic Eutroboralfs. They have an accumulation of clay in the subsoil. The content of rock fragments in the subsoil ranges from 20 to 35 percent. The similar soils are fine-loamy, mixed, frigid Typic Eutrochrepts and loamy-skeletal, mixed Typic Eutroboralfs. They do not have an accumulation of clay in the subsoil. The content of rock fragments in the subsoil ranges from 35 to 50 percent. The dominant and similar soils make up 100 percent of the map unit.

Representative Profile of the Soils

The dominant soils have a surface layer of light brownish gray silt loam about 6 inches thick. The upper part of the subsoil is brownish yellow silty clay loam about 14 inches thick. The lower part to a depth of 60 inches or more is calcareous, very pale brown silty clay loam and gravelly silty clay loam.

Management

Timber

The potential annual production is moderate. The terrain is well suited to the operation of tractors.

Regeneration of the forest is limited by plant competition. Pinegrass competes vigorously with tree seedlings in open areas. Rotting wood is an important source of nitrogen in this unit. Leaving large diameter slash on the site after logging helps to maintain fertility. Trees are susceptible to windthrow because a dense, brittle layer in the subsoil restricts root penetration.

Roads

Material exposed in cutbanks during road construction tends to slough if the cutbanks are steep. If unsurfaced roads are traveled when the soils are wet, the formation of ruts is a hazard. Surface crusting limits revegetation in areas where the lower part of the subsoil has been exposed during construction. Seeding these areas as soon as possible after construction helps to ensure successful revegetation.

Watershed

The hazard of erosion is severe along skid trails and fire lines and in areas where soil material has been exposed by road construction. Sediment delivery efficiency is low.

Wildlife and fisheries

This map unit can provide habitat for big game in winter. The vegetation is commonly old growth forest. The streams generally provide habitat for trout and whitefish. The lakes may provide habitat for trout, bass, and perch. Some lakes are too alkaline for fish to inhabit.

Recreation and visual quality

Hunting, fishing, and viewing scenery are common recreational activities in areas of this map unit. Maintaining the visual quality of the unit is relatively easy. Roadcuts on southerly aspects are noticeable because they are difficult to revegetate.

324—Typic Eutrochrepts, moraines

This map unit is on moraines. Elevation ranges from 2,500 to 4,000 feet. The vegetation consists of dry, mixed forest. The soils formed in calcareous, compact glacial till.

Landform

The dominant slopes have gradients of 15 to 35 percent. The moraines are rolling or hilly deposits of glacial till. They have a deranged drainage pattern. Small lakes are commonly in depressions.

Vegetation

The vegetation is a mixed forest of Douglas-fir, western larch, ponderosa pine, and lodgepole pine. The forest understory is dominated by pinegrass and shrubs.

Habitat Types

Douglas-fir/pinegrass is the major habitat type. Douglas-fir/ninebark and Douglas-fir/snowberry are similar habitat types. These habitat types are in about 85 percent of the unit.

Douglas-fir/twinflower, which is a dissimilar habitat type, is in about 15 percent of the unit. It is on northerly aspects. Its productivity for timber is higher than that of the major habitat type.

Geology

These soils are underlain by calcareous glacial till.

Characteristics of the Soils

These soils have a medium textured surface layer. The content of rounded rock fragments in the subsoil ranges from 20 to 50 percent. The lower part of the subsoil is calcareous.

Map Unit Composition

The dominant soils are loamy-skeletal, mixed, frigid Typic Eutrochrepts. They do not have an accumulation of clay in the subsoil. They are calcareous in the lower part of the subsoil. The content of rock fragments in the subsoil ranges from 35 to 50 percent. The similar soils have an accumulation of clay in the subsoil, are noncalcareous in the lower part of the subsoil, or have a content of rock fragments in the subsoil that ranges from 20 to 35 percent. They are loamy-skeletal, mixed, Typic Eutroboralfs; loamy-skeletal, mixed, frigid Dystric Eutrochrepts; and coarse-loamy, mixed, frigid Typic Eutrochrepts. The dominant and similar soils make up about 90 percent of the unit.

Dissimilar soils make up about 10 percent of the unit. They are fine-silty, mixed Typic Eutroboralfs. They formed in lacustrine deposits. Their subsoil and substratum have low strength and are silty clay loam.

Representative Profile of the Soils

The dominant soils have a surface layer of light brownish gray and light olive brown silt loam about 16 inches thick. The subsoil is calcareous, brown and yellowish brown very gravelly silt loam about 14 inches thick. The substratum to a depth of 60 inches or more is calcareous, light olive brown very gravelly fine sandy loam.

Management

Timber

The potential annual production is moderate. The terrain is well suited to the operation of tractors. Regeneration of the forest is limited by plant

competition. Pinegrass competes vigorously with tree seedlings in open areas. Rotting wood is an important source of nitrogen in this unit. Leaving large diameter slash on the site after logging helps to maintain fertility. Trees are susceptible to windthrow because the dense, brittle substratum restricts root penetration.

Roads

Material exposed in cutbanks during road construction tends to slough if the cutbanks are steep. Tread erosion tends to remove fine textured material from unsurfaced roads. The remaining gravel and cobbles form a rough surface. Surface crusting limits revegetation in areas where the substratum has been exposed during construction. Seeding these areas as soon as possible after construction helps to ensure successful revegetation.

Watershed

The hazard of erosion is moderate along skid trails and fire lines and in areas where soil material has been exposed by road construction. Sediment delivery efficiency is low.

Wildlife and fisheries

This map unit can provide range for big game in winter. The vegetation on moister sites is commonly old growth forest. In places the unit includes mineral licks for big game and provides nesting sites for raptors. The lakes and streams generally provide habitat for trout and whitefish. The lakes also can provide habitat for bass. Some lakes are too alkaline for fish to inhabit.

Recreation and visual quality

Hunting, fishing, and viewing scenery are common recreational activities in areas of this map unit. Maintaining the visual quality of the unit is difficult because revegetating the material exposed by roadcuts is difficult.

325—Aeric Calciaquolls, somewhat poorly drained

This map unit is on flood plains and alluvial fans. Elevation ranges from 2,500 to 4,500 feet. The vegetation consists of moist, mixed forest. The soils formed in calcareous alluvial deposits overlying glacial till.

Landform

The dominant slopes have gradients of 5 to 25 percent. The flood plains and alluvial fans are along small mountain streams. They are seldom flooded. The streams change course frequently.

Vegetation

The vegetation is a mixed forest of subalpine fir, Engelmann spruce, Douglas-fir, western larch, lodgepole pine, and black cottonwood. The forest understory is dominated by shrubs and forbs.

Habitat Types

Subalpine fir/twinflower is the major habitat type. Subalpine fir/queencup beadlily and Engelmann spruce/queencup beadlily are similar habitat types. These habitat types are in about 85 percent of the unit.

Dissimilar habitat types are in about 15 percent of the unit. Douglas-fir/ninebark and Douglas-fir/twinflower are on adjacent uplands. Their productivity for timber is lower than that of the major habitat type.

Geology

The alluvial deposits are mainly silt and finely divided lime. These soils are underlain by calcareous, friable glacial till.

Characteristics of the Soils

These soils have a moderately fine textured surface layer. They are wet. The water table rises to within 12 to 30 inches from the surface in spring when the snow melts. The content of lime in the soils is 40 to 90 percent.

Map Unit Composition

The dominant soils are fine-silty, frigid Aeric Calciaquolls. They make up about 90 percent of the unit.

Dissimilar soils make up about 10 percent of the unit. They are loamy-skeletal, mixed, frigid Typic Eutrochrepts. They are near the boundaries of the mapped areas. They are well drained. Their productivity for timber is lower than that of the dominant soils.

Representative Profile of the Soils

The dominant soils have a surface layer of very dark brown silty clay loam about 8 inches thick. The upper part of the subsoil is dark brown and dark grayish brown. It is about 17 inches thick. The lower part to a depth of 60 inches contains buried black surface layers and buried brownish and yellowish subsoil layers. The texture of the upper part of the profile is silty clay loam and silt loam, and that of the lower part is very gravelly silt loam. The soils are calcareous throughout.

Management

Timber

The potential annual production is high. The operation of tractors is limited in wet areas that have low strength. Compaction and the formation of ruts are hazards. Using cable or aerial logging systems and

piling slash by hand help to overcome these limitations. Regeneration of the forest is limited by frost pockets. Trees are susceptible to windthrow.

Roads

The wetness is a limitation affecting the location and construction of roads. Providing suitable subgrade material helps to prevent the damage caused by wetness and low strength. Material exposed in cutbanks during road construction tends to slough if the cutbanks are steep. If unsurfaced roads are traveled when the soils are wet, the formation of ruts is a hazard.

Watershed

The major concern of watershed management is the protection of streambanks and channels. Carefully locating bridges and culverts helps to maintain the stability of the channels. Changes in the channel can result in a large amount of sediment. Disturbing the soils on or adjacent to the streambanks can result in severe sedimentation. The hazard of erosion is severe along skid trails and fire lines. The material exposed by road construction has a moderate hazard of erosion. The sediment that results from the erosion of these soils is particularly damaging to the spawning habitat of fish. Sediment delivery efficiency is high.

Wildlife and fisheries

This map unit can provide habitat for whitetail deer and moose throughout the year. The streams commonly provide spawning habitat for trout. The unit commonly supports large cottonwoods, which can provide cavity nesting habitat.

Recreation and visual quality

Fishing is the most common recreational activity in areas of this map unit. Maintaining the visual quality of the unit is relatively easy.

328—Andic Cryochrepts, glaciated mountain slopes

This map unit is on glaciated mountain slopes. Elevation ranges from 3,000 to 5,400 feet. The vegetation consists of moist, mixed forest. The soils formed in calcareous, compact glacial till.

Landform

The dominant slopes are on northerly aspects and have gradients of 15 to 35 percent. The glaciated mountain slopes are mantled with glacial till. The drainage pattern is dendritic and widely spaced.

Vegetation

The vegetation is a mixed forest of subalpine fir, western larch, lodgepole pine, Douglas-fir, and Engelmann spruce. The forest understory is dominated by shrubs and forbs.

Habitat Types

Subalpine fir/twinflower is the major habitat type. Subalpine fir/queencup beadlily and subalpine fir/menziesia are similar habitat types. These habitat types are in about 85 percent of the unit.

Dissimilar habitat types are in about 15 percent of the unit. Douglas-fir/twinflower and Douglas-fir/ninebark are on southerly aspects. Their productivity for timber is lower than that of the major habitat type.

Geology

These soils are underlain by calcareous glacial till.

Characteristics of the Soils

These soils have a surface layer of loess that has been influenced by volcanic ash. The surface layer is 4 to 14 inches thick. It is medium textured. The content of rounded rock fragments in the subsoil ranges from 20 to 50 percent. The substratum is calcareous.

Map Unit Composition

The dominant soils are loamy-skeletal, mixed Andic Cryochrepts. They have a surface layer of loess 7 to 14 inches thick. The content of rock fragments in their subsoil ranges from 35 to 50 percent. The similar soils have a surface layer of loess 4 to 7 inches thick. The content of rock fragments in their subsoil ranges from 20 to 35 percent. They are loamy-skeletal, mixed Typic Cryochrepts and fine-loamy, mixed Andic Cryochrepts. The dominant and similar soils make up about 90 percent of the unit.

Dissimilar soils make up about 10 percent of the unit. They are loamy-skeletal, mixed Typic Eutroboralfs. They are on concave slopes and in depressions. They have an accumulation of clay in the subsoil. Their productivity for timber is higher than that of the dominant soils.

Representative Profile of the Soils

The dominant soils have a surface layer of dark brown silt loam about 8 inches thick. The upper part of the subsoil is yellowish brown very stony silt loam about 8 inches thick. The lower part is light olive brown very stony silt loam about 25 inches thick. The substratum to a depth of 60 inches or more is calcareous, dark grayish brown very stony sandy loam.

Management

Timber

The potential annual production is high. Productivity on the site is highly dependent on the loess surface layer. If tractors are operated on the site, productivity

can be lowered because the loess surface layer can become compacted or be displaced or it can be mixed with subsoil material. Trees are susceptible to windthrow because the dense, brittle substratum restricts root penetration.

Roads

Material exposed in cutbanks during road construction tends to slough if the cutbanks are steep. Tread erosion tends to remove fine textured material from unsurfaced roads. The remaining gravel and cobbles form a rough surface. Surface crusting limits revegetation in areas where the substratum has been exposed during construction. Seeding these areas as soon as possible after construction helps to ensure successful revegetation.

Watershed

The hazard of erosion is moderate along skid trails and fire lines and in areas where soil material has been exposed by road construction. Sediment delivery efficiency is moderate.

Wildlife and fisheries

This map unit can provide habitat for big game in summer. In some places it provides food sources for grizzly bears. In other places it includes mineral licks for big game. The vegetation is commonly old growth forest that includes snags suitable for use as cavity nesting habitat.

Recreation and visual quality

Gathering wood and picking berries are common recreational activities in areas of this map unit. Maintaining the visual quality of the unit is relatively easy.

329—Andic Cryochrepts, moraines, dense, brittle substratum

This map unit is on moraines. Elevation ranges from 3,000 to 5,500 feet. The vegetation consists of subalpine forest. The soils formed in calcareous, compact glacial till.

Landform

The dominant slopes have gradients of 15 to 35 percent. The moraines are rolling or hilly deposits of glacial till. The drainage pattern is dendritic on side slopes. Ridges have no defined drainage pattern.

Vegetation

The vegetation is a mixed forest of subalpine fir, Engelmann spruce, Douglas-fir, western larch, and lodgepole pine. The forest understory is dominated by forbs and low-growing shrubs.

Habitat Types

Subalpine fir/twinflower is the major habitat type. Subalpine fir/blue huckleberry and subalpine fir/menziesia are similar habitat types. These habitat types are in about 85 percent of the unit.

Dissimilar habitat types are in about 15 percent of the unit. Subalpine fir/beargrass and subalpine fir/grouse whortleberry are on ridges. Their productivity for timber is lower than that of the major habitat type.

Geology

These soils are underlain by calcareous glacial till.

Characteristics of the Soils

These soils have a surface layer of loess that has been influenced by volcanic ash. The surface layer is 4 to 14 inches thick. It is medium textured. The content of rounded rock fragments in the subsoil ranges from 20 to 50 percent. The substratum is calcareous.

Map Unit Composition

The dominant soils are loamy-skeletal, mixed Andic Cryochrepts. They have a surface layer of loess 7 to 14 inches thick. The content of rock fragments in their subsoil ranges from 35 to 50 percent. The similar soils have a surface layer of loess 4 to 7 inches thick or have a content of rock fragments in the subsoil that ranges from 20 to 35 percent. They are loamy-skeletal, mixed Dystric Cryochrepts and fine-loamy, mixed Andic Cryochrepts. The dominant and similar soils make up about 80 percent of the unit.

Rock outcrop and dissimilar soils make up about 20 percent of the unit. They are on ridges. The dissimilar soils are loamy-skeletal, mixed Lithic Cryochrepts. They are 4 to 20 inches deep over bedrock. Their productivity for timber is lower than that of the dominant soils.

Representative Profile of the Soils

The dominant soils have a surface layer of dark brown silt loam about 8 inches thick. The upper part of the subsoil is yellowish brown very stony silt loam about 8 inches thick. The lower part is light olive brown very stony silt loam about 25 inches thick. The substratum to a depth of 60 inches or more is calcareous, dark grayish brown very stony sandy loam.

Management

Timber

The potential annual production is high. Productivity on the site is highly dependent on the loess surface layer. If tractors are operated on the site, productivity can be lowered because the loess surface layer can become compacted or be displaced or it can be mixed with subsoil material. Trees are susceptible to

windthrow because the dense, brittle substratum restricts root penetration.

Roads

Material exposed in cutbanks during road construction tends to slough if the cutbanks are steep. Tread erosion tends to remove fine textured material from unsurfaced roads. The remaining gravel and cobbles form a rough surface. Surface crusting limits revegetation in areas where the substratum has been exposed during construction. Seeding these areas as soon as possible after construction helps to ensure successful revegetation.

Watershed

The hazard of erosion is moderate along skid trails and fire lines and in areas where soil material has been exposed by road construction. Sediment delivery efficiency is low.

Wildlife and fisheries

This map unit can provide habitat for big game in summer. In places it provides food sources for grizzly bears.

Recreation and visual quality

Gathering wood and picking berries are common recreational activities in areas of this map unit. Maintaining the visual quality of the unit is relatively easy.

351—Andic Dystrochrepts, dissected glaciated mountain slopes

This map unit is on dissected glaciated mountain slopes. Elevation ranges from 3,000 to 4,500 feet. The vegetation consists of moist, mixed forest. The soils formed in compact glacial till.

Landform

The dominant slopes are on northerly aspects and have gradients of 30 to 60 percent. The dissected glaciated mountain slopes have a mantle of glacial till and closely spaced, deeply incised, V-shaped drainageways. The drainageways are on the lower two-thirds of the slopes. They are first order and flow directly into third- and fourth-order streams. The drainage pattern is parallel. Landslides can occur in the drainageways.

Vegetation

The vegetation is a mixed forest of western hemlock, western redcedar, western larch, subalpine fir, western white pine, Douglas-fir, grand fir, Engelmann spruce, and lodgepole pine. The forest understory is dominated by shrubs and forbs.

Habitat Types

Western hemlock/queencup beadlily and western redcedar/queencup beadlily are the major habitat types. Subalpine fir/queencup beadlily, subalpine fir/devil's club, and subalpine fir/menziesia are similar habitat types. These habitat types are in about 85 percent of the unit.

Douglas-fir/ninebark, which is a dissimilar habitat type, is in about 15 percent of the unit. It is at the lower elevations in the Salish Range and the eastern part of the Purcell Range. Its productivity for timber is lower than that of the major habitat types.

Geology

These soils are underlain by dense, brittle glacial till.

Characteristics of the Soils

These soils have a surface layer of loess that has been influenced by volcanic ash. The surface layer is 4 to 14 inches thick. It is medium textured. The content of rounded rock fragments in the subsoil ranges from 20 to 50 percent. The substratum is dense and brittle when moist.

Map Unit Composition

The dominant soils are loamy-skeletal, mixed, frigid Andic Dystrochrepts. They have a surface layer of loess 7 to 14 inches thick. The content of rock fragments in their subsoil ranges from 35 to 50 percent. The similar soils have a surface layer of loess 4 to 7 inches thick or have a content of rock fragments in the subsoil that ranges from 20 to 35 percent. They are loamy-skeletal, mixed, frigid Typic Dystrochrepts and coarse-loamy, mixed, frigid Andic Dystrochrepts. The dominant and similar soils make up about 85 percent of the unit.

Rock outcrop and dissimilar soils make up about 15 percent of the unit. The dissimilar soils are loamy-skeletal, mixed, frigid Andic Haplumbrepts and loamy-skeletal, mixed, frigid Lithic Dystrochrepts. The Andic Haplumbrepts are along drainageways. They have a dark surface layer and a water table that fluctuates. The rock outcrop and the Lithic Dystrochrepts are on the upper slopes and ridgetops. The Lithic Dystrochrepts are 4 to 20 inches deep over bedrock. Their productivity for timber is lower than that of the dominant soils.

Representative Profile of the Soils

The dominant soils are yellowish brown gravelly silt loam in the upper 7 inches of the surface layer. They are very pale brown very gravelly very fine sandy loam in the lower 13 inches of the surface layer. The subsoil is strong brown very gravelly very fine sandy loam about 21 inches thick. The substratum to a depth of 60 inches or more is dense, brittle, pale brown very gravelly very fine sandy loam.

Management

Timber

The potential annual production is high. The slope limits the operation of tractors. Trees are susceptible to windthrow because the dense, brittle substratum restricts root penetration.

Roads

The closely spaced, deeply incised drainageways increase the amount of material that is excavated during road construction. Material exposed in cutbanks during road construction tends to slough if the cutbanks are steep. The frequency of landslides in drainageways may increase because of the roads. Tread erosion tends to remove fine textured material from unsurfaced roads. The remaining gravel and cobbles form a rough surface. Surface crusting limits revegetation in areas where the substratum has been exposed during construction. Seeding these areas as soon as possible after construction helps to ensure successful revegetation.

Watershed

The hazard of erosion is moderate along skid trails and fire lines and in areas where soil material has been exposed by road construction. Sediment delivery efficiency is high.

Wildlife and fisheries

This map unit can provide habitat for mule deer and elk in summer. The vegetation is old growth forest, which is suitable for use as cavity nesting habitat.

Recreation and visual quality

This map unit does not provide opportunities for common recreational activities. Maintaining the visual quality of the unit is difficult because roadcuts on steep slopes are obtrusive if they are not vegetated.

352—Andic Dystrochrepts, glaciated mountain slopes

This map unit is on glaciated mountain slopes. Elevation ranges from 2,200 to 5,600 feet. The vegetation consists of moist, mixed forest. The soils formed in compact glacial till.

Landform

The dominant slopes are on northerly aspects and have gradients of 20 to 60 percent. The glaciated mountain slopes are mantled with glacial till. The drainage pattern is dendritic. The drainageways are widely spaced.

Vegetation

The vegetation is a mixed forest of western larch, Douglas-fir, lodgepole pine, and grand fir. Western hemlock, western redcedar, and western white pine are included in the Cabinet Range and the western part of the Purcell Range. Subalpine fir is included in the Salish Range and the eastern part of the Purcell Range. The forest understory is dominated by forbs and low-growing shrubs.

Habitat Types

Habitat types vary in this map unit depending on location. In the Cabinet Range and the western part of the Purcell Range, western redcedar/queencup beadlily and western hemlock/queencup beadlily are the major habitat types. Grand fir/queencup beadlily, western redcedar/devil's club, and grand fir/twinflower are similar habitat types. In the Salish Range and the eastern part of the Purcell Range, subalpine fir/queencup beadlily is the major habitat type. Subalpine fir/twinflower, subalpine fir/Sitka alder, and subalpine fir/menziesia are similar habitat types. These habitat types are in about 85 percent of the unit.

Dissimilar habitat types are in about 15 percent of the unit. Douglas-fir/twinflower and Douglas-fir/blue huckleberry are at the lower elevations. Their productivity for timber is lower than that of the major habitat types.

Geology

These soils are underlain by dense, brittle glacial till.

Characteristics of the Soils

These soils have a surface layer of loess that has been influenced by volcanic ash. The surface layer is 4 to 14 inches thick. It is medium textured. The content of rounded rock fragments in the subsoil ranges from 20 to 50 percent. The substratum is dense and brittle when moist.

Map Unit Composition

The dominant soils are loamy-skeletal, mixed, frigid Andic Dystrochrepts. They have a surface layer of loess 7 to 14 inches thick. The content of rock fragments in their subsoil ranges from 35 to 50 percent. The similar soils have a surface layer of loess 4 to 7 inches thick or have a content of rock fragments in the subsoil ranging from 20 to 35 percent. They are loamy-skeletal, mixed, frigid Typic Dystrochrepts and coarse-loamy, mixed, frigid Andic Dystrochrepts. The dominant and similar soils make up about 85 percent of the unit.

Dissimilar soils make up about 15 percent of the unit. They are loamy-skeletal, mixed, frigid Andic Haplumbrepts and loamy-skeletal, mixed, frigid Lithic Dystrochrepts. The Andic Haplumbrepts are along drainageways and in depressions. They have a dark surface layer and a water table that fluctuates. The

Lithic Dystrochrepts are on ridges. They are 4 to 20 inches deep over bedrock. Their productivity for timber is lower than that of the dominant soils.

Representative Profile of the Soils

The dominant soils are yellowish brown gravelly silt loam in the upper 7 inches of the surface layer. They are very pale brown very gravelly very fine sandy loam in the lower 13 inches of the surface layer. The subsoil is strong brown very gravelly very fine sandy loam about 21 inches thick. The substratum to a depth of 60 inches or more is dense, brittle, pale brown very gravelly very fine sandy loam.

Management

Timber

The potential annual production is high. The slope limits the operation of tractors in some areas. A combination of tractor and cable logging systems helps to overcome the slope. Productivity on the site is highly dependent on the loess surface layer. If tractors are operated on the site, productivity can be lowered because the loess surface layer can become compacted or be displaced or it can be mixed with subsoil material. Trees are susceptible to windthrow because the dense, brittle substratum restricts root penetration.

Roads

Material exposed in cutbanks during road construction tends to slough if the cutbanks are steep. Tread erosion tends to remove fine textured material from unsurfaced roads. The remaining gravel and cobbles form a rough surface. Surface crusting limits revegetation in areas where the substratum has been exposed during construction. Seeding these areas as soon as possible after construction helps to ensure successful revegetation.

Watershed

The hazard of erosion is moderate along skid trails and fire lines and in areas where soil material has been exposed by road construction. Sediment delivery efficiency is moderate.

Wildlife and fisheries

This map unit can provide habitat for big game in summer. In places the vegetation is old growth forest, which provides cavity nesting habitat. The unit provides some food sources for grizzly bears. The streams provide habitat for trout and, in places, can provide spawning habitat.

Recreation and visual quality

Gathering wood, hiking, camping, fishing, hunting, picking berries, sightseeing by car, and participating in various winter sports are common recreational activities in areas of this map unit. Maintaining the visual quality of the unit is relatively easy, but roadcuts on steep slopes are obtrusive if they are not vegetated.

353—Andic Cryochrepts-Rock outcrop-Lithic Cryochrepts complex, glaciated mountain ridges

This map unit is on glaciated mountain ridges. Elevation ranges from 4,000 to 6,000 feet. The vegetation consists of subalpine forest and moist, mixed forest. The soils formed mostly in material weathered from metasedimentary rocks.

Landform

The dominant slopes have gradients of 15 to 35 percent. The glaciated mountain ridges have a thin mantle of glacial till. The drainage pattern is dendritic and widely spaced.

Vegetation

The vegetation is a mixed forest of subalpine fir, Douglas-fir, Engelmann spruce, lodgepole pine, and some western larch. The forest understory is dominated by forbs and low-growing shrubs. Beargrass is common.

Habitat Types

Habitat types vary with aspect. Subalpine fir/beargrass is the major habitat type on southerly aspects. Subalpine fir/grouse whortleberry is a similar habitat type. These habitat types are in about 50 percent of the forested part of the unit. Subalpine fir/twinflower is the major habitat type on northerly aspects. Subalpine fir/blue huckleberry is a similar habitat type. These habitat types are in about 35 percent of the forested part of the unit.

Dissimilar habitat types are in about 15 percent of the unit. Douglas-fir habitat types are at the lower elevations. Their productivity for timber is lower than that of the major habitat types.

Geology

This map unit is underlain by argillite, siltite, and quartzite of the Belt supergroup. Thin deposits of dense, brittle glacial till overlie the bedrock in places.

Characteristics of the Soils

The soils in this map unit have a surface layer of loess that has been influenced by volcanic ash. The surface layer is 4 to 14 inches thick. It is medium textured. The content of angular rock fragments in the subsoil ranges from 45 to 70 percent. The soils are not easily identified by unique landscape features. They are either 4 to 20 inches deep over bedrock or 20 to 60 inches deep over bedrock.

Map Unit Composition

The dominant soils are loamy-skeletal, mixed Andic Cryochrepts and loamy-skeletal, mixed Lithic Cryochrepts.

The Andic Cryochrepts are 20 to 60 inches deep over bedrock. They have a surface layer of loess 7 to 14 inches thick. The similar soils have a surface layer of loess 4 to 7 inches thick. They are loamy-skeletal, mixed Typic Cryochrepts. The Andic Cryochrepts and similar soils make up about 50 percent of the unit.

The Lithic Cryochrepts are 4 to 20 inches deep over bedrock. They make up about 20 percent of the unit.

The Rock outcrop is in areas throughout the map unit. It makes up about 30 percent of the unit.

The components of this unit occur in areas so intricately mixed that it was not practical to map them separately at the scale used.

Representative Profile of the Soils

The Andic Cryochrepts have a surface layer of dark brown silt loam about 8 inches thick. The upper part of the subsoil is yellowish brown very stony silt loam about 8 inches thick. The lower part is light olive brown very stony silt loam about 25 inches thick. The substratum to a depth of 60 inches or more is dark grayish brown very stony sandy loam.

The Lithic Cryochrepts have a surface layer of yellowish brown stony silt loam about 8 inches thick. The subsoil is pale brown very stony silt loam. Bedrock is at a depth of about 20 inches.

Management

Timber

The potential annual production is high in areas of the Andic Cryochrepts and very low in areas of the Lithic Cryochrepts. Productivity in the map unit is limited by the Rock outcrop. Regeneration of the forest is limited by the harsh subalpine climate on southerly aspects. Productivity on the site is highly dependent on the loess surface layer. If tractors are operated on the site, productivity can be lowered because the loess surface layer can become compacted or be displaced or it can be mixed with subsoil material. Trees growing in areas of the Lithic Cryochrepts are susceptible to windthrow.

Roads

The hard rock frequently limits excavation during road construction. Unsurfaced roads are rough because of large stones or cobbles. Material exposed during road construction on southerly aspects is difficult to revegetate because of moisture stress. If the hard rock is excavated, the cut and fill material is extremely stony and has a low water-holding capacity.

Watershed

Erosion is a moderate hazard along skid trails and fire lines. The material exposed by road construction has a slight hazard of erosion. Sediment delivery efficiency is low.

Wildlife and fisheries

This map unit commonly can provide denning sites and food sources for grizzly bears. It can provide habitat for big game in summer. In places it provides brooding sites for grouse and nesting areas for raptors.

Recreation and visual quality

Hiking, viewing wildlife, photographing wild flowers, and cross-country skiing are common recreational activities in areas of this map unit. Maintaining the visual quality of the unit is difficult because rock is exposed in roadcuts and the forest has openings in areas of the Rock outcrop.

355—Andic Dystrochrepts-Rock outcrop complex, glaciated mountain slopes

This map unit is on glaciated mountain slopes. Elevation ranges from 3,000 to 5,500 feet. The vegetation consists of moist, mixed forest. The soils formed in compact glacial till.

Landform

The dominant slopes are on northerly aspects and have gradients of 20 to 50 percent. The glaciated mountain slopes are mantled with glacial till. They are at midelevation on ridgetops and ridge noses. The drainage pattern is dendritic, and drainageways are widely spaced.

Vegetation

The vegetation is a mixed forest of Douglas-fir, western larch, and lodgepole pine. Western hemlock, western redcedar, western white pine, and grand fir are included in the Cabinet Range and the western part of the Purcell Range. Subalpine fir and Engelmann spruce are included in the Salish Range and the eastern part of the Purcell Range. The forest understory is dominated by shrubs and forbs.

Habitat Types

Habitat types vary in this map unit depending on location. In the Cabinet Range and the western part of the Purcell Range, western redcedar/queencup beadlily and western hemlock/queencup beadlily are the major habitat types. In the Salish Range and the eastern part of the Purcell Range, subalpine fir/queencup beadlily is the major habitat type. Subalpine fir/blue huckleberry, subalpine fir/menziesia, and subalpine fir/twinflower are

similar habitat types. These habitat types are in about 85 percent of the forested part of the unit.

Dissimilar habitat types are in about 15 percent of the forested part of the unit. Subalpine fir/beargrass is at the higher elevations, and Douglas-fir/pinegrass, Douglas-fir/twinflower, and Douglas-fir/ninebark are at the lower elevations. Their productivity for timber is lower than that of the major habitat types.

Geology

This map unit is underlain by dense, brittle glacial till.

Characteristics of the Soils

The soils in this map unit have a surface layer of loess that has been influenced by volcanic ash. The surface layer is 4 to 14 inches thick. It is medium textured. The content of rounded rock fragments in the subsoil ranges from 20 to 50 percent. The substratum is dense and brittle when moist.

Map Unit Composition

The dominant soils are loamy-skeletal, mixed, frigid Andic Dystrochrepts. They have a surface layer of loess 7 to 14 inches thick. The content of rock fragments in their subsoil ranges from 35 to 50 percent. The similar soils have a surface layer of loess 4 to 7 inches thick or have a content of rock fragments in the subsoil that ranges from 20 to 35 percent. They are loamy-skeletal, mixed, frigid Typic Dystrochrepts and coarse-loamy, mixed, frigid Andic Dystrochrepts. The dominant and similar soils make up about 70 percent of the unit.

The Rock outcrop is on ridgetops. It makes up about 20 percent of the unit.

The components of this unit occur in areas so intricately mixed that it was not practical to map them separately at the scale used.

Dissimilar soils make up about 10 percent of the unit. They are loamy-skeletal, mixed, frigid Lithic Dystrochrepts. They are on ridgetops. They are 4 to 20 inches deep over bedrock. Their productivity for timber is lower than that of the dominant soils.

Representative Profile of the Soils

The dominant soils are yellowish brown gravelly silt loam in the upper 7 inches of the surface layer. The lower 13 inches of the surface layer is very pale brown very gravelly very fine sandy loam. The subsoil is strong brown very gravelly very fine sandy loam about 21 inches thick. The substratum to a depth of 60 inches or more is dense, brittle, pale brown very gravelly very fine sandy loam.

Management

Timber

The potential annual production is high in forested areas. Productivity in the map unit is limited by the Rock outcrop. The Rock outcrop limits the operation of tractors on ridgetops. Trees are susceptible to windthrow because the dense, brittle substratum restricts root penetration.

Roads

The hard rock frequently limits excavation during road construction. Unsurfaced roads are rough because of large stones or cobbles. Material exposed during road construction on ridgetops is difficult to revegetate because of moisture stress. If the hard rock is excavated, the cut and fill material is extremely stony and has a low water-holding capacity.

Watershed

The hazard of erosion is moderate along skid trails and fire lines and in areas where soil material has been exposed by road construction. Sediment delivery efficiency is moderate.

Wildlife and fisheries

This map unit can provide habitat for big game in summer. The vegetation commonly is old growth forest that includes snags suitable for use as cavity nesting habitat. In places the unit provides food sources for grizzly bears.

Recreation and visual quality

Driving for pleasure, gathering wood, and picking berries are common recreational activities in areas of this map unit. Maintaining the visual quality of the unit is difficult because rock is exposed in roadcuts and the forest has openings in areas of the Rock outcrop.

357—Andic Cryochrepts-Lithic Cryochrepts complex, dissected glaciated mountain slopes

This map unit is on dissected glaciated mountain slopes. Elevation ranges from 3,500 to 5,500 feet. The vegetation consists of moist, mixed forest. The soils formed in compact glacial till and material weathered from metasedimentary rocks.

Landform

The dominant slopes are on northerly aspects and have gradients of 30 to 60 percent. The dissected glaciated mountain slopes are long and straight. They are mantled with glacial till. Drainageways are closely spaced and deeply incised. They are first order and flow directly into third- and fourth-order streams. The drainage pattern is parallel. Landslides can occur in the drainageways.

Vegetation

The vegetation is a mixed forest of western hemlock, western red cedar, western white pine, grand fir,

subalpine fir, Douglas-fir, and lodgepole pine. The forest understory is dominated by shrubs and forbs. Menziesia is common.

Habitat Types

Subalpine fir/menziesia is the major habitat type. Subalpine fir/queencup beadlily, grand fir/queencup beadlily, and western hemlock/queencup beadlily are similar habitat types. These habitat types are in about 85 percent of the unit.

Douglas-fir/ninebark, which is a dissimilar habitat type, is in about 15 percent of the unit. It is at the lower elevations. Its productivity for timber is lower than that of the major habitat type.

Geology

These soils are underlain by argillite, siltite, and quartzite of the Belt supergroup. Thin deposits of dense, brittle glacial till overlie the bedrock in places.

Characteristics of the Soils

These soils have a surface layer of loess that has been influenced by volcanic ash. The surface layer is 4 to 14 inches thick. It is medium textured. The soils are not easily identified by unique landscape features. They are either 4 to 20 inches deep over bedrock or 20 to 60 inches deep over bedrock.

Map Unit Composition

The dominant soils are loamy-skeletal, mixed Andic Cryochrepts and loamy-skeletal, mixed Lithic Cryochrepts.

The Andic Cryochrepts are 20 to 60 inches deep over bedrock. They have a surface layer of loess 7 to 14 inches thick. The content of rock fragments in their subsoil ranges from 35 to 50 percent. The similar soils have a surface layer of loess 4 to 7 inches thick or have a content of rock fragments in the subsoil that ranges from 20 to 35 percent. They are loamy-skeletal, mixed Typic Cryochrepts and coarse-loamy, mixed Andic Cryochrepts. These dominant and similar soils make up about 65 percent of the unit.

The Lithic Cryochrepts are 4 to 20 inches deep over bedrock. They make up about 25 percent of the unit.

The components of this unit occur in areas so intricately mixed that it was not practical to map them separately at the scale used.

Rock outcrop, which is a dissimilar inclusion, is on ridgetops. It makes up about 10 percent of the unit.

Representative Profile of the Soils

The dominant Andic Cryochrepts have a surface layer of dark brown silt loam about 8 inches thick. The upper part of the subsoil is yellowish brown very stony silt loam about 8 inches thick. The lower part is light olive brown very stony silt loam about 25 inches thick. The substratum to a depth of 60 inches or more is dark grayish brown very stony sandy loam.

The Lithic Cryochrepts have a surface layer of yellowish brown stony silt loam about 8 inches thick. The subsoil is pale brown very stony silt loam. Bedrock is at a depth of about 20 inches.

Management

Timber

The potential annual production is high. The slope limits the operation of tractors. Regeneration of the forest is limited by plant competition. Menziesia competes vigorously with tree seedlings in open areas. Trees growing in areas of the Lithic Cryochrepts are susceptible to windthrow.

Roads

The hard rock frequently limits excavation during road construction. If the hard rock is excavated, the cut and fill material is extremely stony and has a low water-holding capacity. The closely spaced, deeply incised drainageways increase the amount of material that is excavated during road construction. The frequency of landslides in the drainageways may increase because of the roads. Unsurfaced roads are rough because of large stones or cobbles. Material exposed during road construction is difficult to revegetate because of moisture stress.

Watershed

The hazard of erosion is moderate along skid trails and fire lines and in areas where soil material has been exposed by road construction. Sediment delivery efficiency is high.

Wildlife and fisheries

This map unit can provide habitat for big game in summer. The vegetation is commonly old growth forest that includes snags suitable for use as cavity nesting habitat. In places the unit provides food sources for grizzly bears.

Recreation and visual quality

Driving for pleasure, hunting, picking berries, and gathering wood are common recreational activities in areas of this map unit. Maintaining the visual quality of the unit is difficult because revegetating roadcuts is difficult.

360—Rock outcrop-Lithic Cryochrepts complex, glaciated mountain ridges

This map unit is on glaciated mountain ridges. Elevation ranges from 4,500 to 6,000 feet. The

vegetation consists of subalpine forest. The soils formed in material weathered from metasedimentary rocks.

Landform

The dominant slopes have gradients of 15 to 35 percent. The glaciated mountain ridges have thin deposits of glacial till in places. Almost no surface drainageways are on the mountain ridges.

Vegetation

The vegetation is scattered subalpine fir, lodgepole pine, and some Engelmann spruce. The forest understory is dominated by forbs and low-growing shrubs. Beargrass is common.

Habitat Types

Subalpine fir/beargrass is the major habitat type. Subalpine fir/grouse whortleberry is a similar habitat type. These habitat types are in about 85 percent of the forested part of the unit.

Dissimilar habitat types are in about 15 percent of the forested part of the unit. Subalpine fir/queencup beadlily and subalpine fir/menziesia are at the lower elevations. Their productivity is higher than that of the major habitat type.

Geology

This map unit is underlain by argillite, siltite, and quartzite of the Belt supergroup. Thin deposits of dense, brittle glacial till overlie the bedrock in places.

Characteristics of the Soils

The soils in this map unit have a surface layer of loess that has been influenced by volcanic ash. The surface layer is 4 to 8 inches thick. It is medium textured. The soils are 4 to 20 inches deep over bedrock. The content of angular rock fragments in the subsoil ranges from 45 to 70 percent.

Map Unit Composition

The Rock outcrop is in areas throughout the map unit. It makes up about 60 percent of the unit.

The dominant soils are loamy-skeletal, mixed Lithic Cryochrepts. They are in areas throughout the map unit. They make up about 30 percent of the unit.

The components of this unit occur in areas so intricately mixed that it was not practical to map them separately at the scale used.

Dissimilar soils make up about 10 percent of the unit. They are loamy-skeletal, mixed Andic Cryochrepts. They are on concave, lower slopes. They are 20 to 60 inches deep over bedrock. Their productivity is higher than that of the dominant soils.

Representative Profile of the Soils

The dominant soils have a surface layer of yellowish brown stony silt loam about 8 inches thick. The subsoil is pale brown very stony silt loam. Bedrock is at a depth of about 20 inches.

Management

Timber

The potential annual production is very low in forested areas. The productivity is limited by the depth to bedrock. The productivity in the map unit is limited by the Rock outcrop. The Rock outcrop limits the operation of tractors. Regeneration of the forest is limited by the harsh subalpine climate. Trees growing in areas of the Lithic Cryochrepts are susceptible to windthrow.

Roads

The hard rock frequently limits excavation during road construction. Unsurfaced roads are rough because of large stones or cobbles. Material exposed during road construction is difficult to revegetate because of moisture stress. If the hard rock is excavated, the cut and fill material is extremely stony and has a low water-holding capacity.

Watershed

No special watershed protection measures are needed for the management practices that are commonly applied in this map unit.

Wildlife and fisheries

This map unit can provide denning sites and food sources for grizzly bears. It provides habitat for big game in summer. In places it provides brooding sites for grouse and nesting areas for raptors.

Recreation and visual quality

Hiking, photographing wild flowers, cross-country skiing, and snowmobiling are common recreational activities in areas of this map unit. Maintaining the visual quality of the unit is difficult because the forest cover is sparse and because rock is exposed in road cutbanks.

365—Andic Dystrochrepts, dissected glaciated mountain slopes, steep

This map unit is on dissected glaciated mountain slopes. Elevation ranges from 2,500 to 5,500 feet. The vegetation consists of moist, mixed forest. The soils formed in compact glacial till.

Landform

The dominant slopes are on northerly aspects and have gradients of 60 to 80 percent. The dissected glaciated mountain slopes have closely spaced, short,

deeply incised first-order drainageways. The drainage pattern is parallel. The drainageways flow into third- and fourth-order streams. Landslides can occur in the drainageways.

Vegetation

The vegetation is a mixed forest of western hemlock, western redcedar, western larch, subalpine fir, western white pine, Douglas-fir, grand fir, Engelmann spruce, and lodgepole pine. The forest understory is dominated by shrubs and forbs. Menziesia is common.

Habitat Types

Western hemlock/queencup beadlily and western redcedar/queencup beadlily are the major habitat types. Subalpine fir/menziesia and subalpine fir/queencup beadlily are similar habitat types. These habitat types are in 100 percent of the unit.

Geology

These soils are underlain by dense, brittle glacial till.

Characteristics of the Soils

These soils have a surface layer of loess that has been influenced by volcanic ash. The surface layer is 4 to 14 inches thick. It is medium textured. The content of rounded rock fragments in the subsoil ranges from 20 to 50 percent. The substratum is dense and brittle when moist.

Map Unit Composition

The dominant soils are loamy-skeletal, mixed, frigid Andic Dystrochrepts. They have a surface layer of loess 7 to 14 inches thick. The content of rock fragments in their subsoil ranges from 35 to 50 percent. The similar soils have a surface layer of loess 4 to 7 inches thick or have a content of rock fragments in the subsoil that ranges from 20 to 35 percent. They are loamy-skeletal, mixed, frigid Typic Dystrochrepts and coarse-loamy, mixed, frigid Andic Dystrochrepts. The dominant and similar soils make up about 80 percent of the unit.

Dissimilar soils and rock outcrop make up about 20 percent of the unit. The dissimilar soils are loamy-skeletal, mixed, frigid Andic Haplumbrepts. They are along drainageways. They have a dark surface layer and a water table that fluctuates. The rock outcrop is on the upper slopes and the edge of ridges.

Representative Profile of the Soils

The dominant soils are yellowish brown gravelly silt loam in the upper 7 inches of the surface layer. The lower 13 inches of the surface layer is very pale brown very gravelly very fine sandy loam. The subsoil is strong brown very gravelly very fine sandy loam about 21 inches thick. The substratum to a depth of 60 inches or more is dense, brittle, pale brown very gravelly very fine sandy loam.

Management

Timber

The potential annual production is high. The slope severely limits the operation of tractors. Cable logging systems are safer and disturb the soil less than tractor logging systems. Trees are susceptible to windthrow because the dense, brittle substratum restricts root penetration.

Roads

The slope and the closely spaced, deeply incised drainageways increase the amount of material that is excavated during road construction. Material exposed in cutbanks during road construction tends to slough if the cutbanks are steep. Surface crusting limits revegetation in areas where the substratum has been exposed during construction. Seeding these areas as soon as possible after construction helps to ensure successful revegetation. The frequency of landslides in the drainageways may increase because of the roads. Tread erosion tends to remove fine textured material from unsurfaced roads. The remaining gravel and cobbles form a rough surface.

Watershed

The hazard of erosion is moderate along skid trails and fire lines and in areas where soil material has been exposed by road construction. The frequency of landslides may increase because of the roads. Slopes are very steep, and the drainageways are relatively close together. The sediment produced by the landslides and erosion moves rapidly through the drainage system to the larger streams at the base of these slopes. Sediment delivery efficiency is high.

Wildlife and fisheries

This map unit can provide good habitat for mule deer and elk in summer. The vegetation is commonly old growth forest that includes snags suitable for use as cavity nesting habitat.

Recreation and visual quality

Traveling on roads and trails is the most common recreational activity in areas of this map unit. Maintaining the visual quality of the unit is difficult because roadcuts are obtrusive if they are not vegetated.

370—Andic Dystrochrepts, glaciated mountain slopes, granitic substratum

This map unit is on glaciated mountain slopes. Elevation ranges from 3,800 to 6,000 feet. The vegetation consists of moist, mixed forest. The soils formed in material weathered from granitic rocks.

Landform

The dominant slopes have gradients of 15 to 35 percent. The glaciated mountain slopes are mantled with glacial till. The drainage pattern is deranged, and drainage channels are widely spaced.

Vegetation

The vegetation is a mixed forest of western hemlock, western redcedar, western white pine, western larch, Douglas-fir, subalpine fir, and grand fir. The forest understory is dominated by shrubs and forbs.

Habitat Types

Western hemlock/queencup beadlily and western redcedar/queencup beadlily are the major habitat types. Subalpine fir/queencup beadlily and subalpine fir/menziesia are similar habitat types. These habitat types are in about 85 percent of the unit.

Dissimilar habitat types are in about 15 percent of the unit. Subalpine fir/grouse whortleberry and subalpine fir/beargrass are at the higher elevations. Their productivity for timber is lower than that of the major habitat types.

Geology

These soils are underlain by granitic rock. A thin mantle of friable glacial till overlies the bedrock.

Characteristics of the Soils

These soils have a surface layer of loess that has been influenced by volcanic ash. The surface layer is 4 to 14 inches thick. It is medium textured. The content of rounded rock fragments in the subsoil ranges from 20 to 50 percent.

Map Unit Composition

The dominant soils are loamy-skeletal, mixed, frigid Andic Dystrochrepts. They have a surface layer of loess 7 to 14 inches thick. The content of rock fragments in their subsoil ranges from 35 to 50 percent. The similar soils have a surface layer of loess 4 to 7 inches thick or have a content of rock fragments in the subsoil that ranges from 20 to 35 percent. They are loamy-skeletal, mixed, frigid Typic Dystrochrepts and coarse-loamy, mixed, frigid Andic Dystrochrepts. The dominant and similar soils make up about 90 percent of the unit.

Dissimilar soils make up about 10 percent of the unit. They are loamy-skeletal, mixed, frigid Andic Haplumbrepts. They are along drainageways or in depressions. They have a dark surface layer and a water table that fluctuates.

Representative Profile of the Soils

The dominant soils are yellowish brown gravelly silt loam in the upper 7 inches of the surface layer. The lower 13 inches of the surface layer is very pale brown very gravelly very fine sandy loam. The subsoil is strong brown very gravelly very fine sandy loam about 21 inches thick. The substratum to a depth of 60 inches or more is pale brown very gravelly very fine sandy loam.

Management

Timber

The potential annual production is high. Productivity on the site is highly dependent on the loess surface layer. If tractors are operated on the site, productivity can be lowered because the loess surface layer can become compacted or be displaced or it can be mixed with subsoil material.

Roads

Material exposed in cutbanks during road construction tends to ravel if the cutbanks are steep. Tread erosion tends to remove fine textured material from unsurfaced roads. The remaining gravel and cobbles form a rough surface. Unsurfaced roads have a loose, gravelly or cobbly sandy surface when the soils are dry.

Watershed

Erosion is a moderate hazard along skid trails and fire lines. The material exposed by road construction has a severe hazard of erosion. Sediment delivery efficiency is moderate.

Wildlife and fisheries

This map unit can provide habitat for big game in summer. In some places the vegetation is old growth forest, which provides cavity nesting habitat. In other places the unit provides food sources for grizzly bears.

Recreation and visual quality

Hiking, sightseeing by car, hunting, and picking berries are common recreational activities in areas of this map unit. Maintaining the visual quality of the unit is difficult because roadcuts on steep slopes are obtrusive if they are not vegetated.

381—Typic Ustochrepts-Lithic Ustochrepts complex, dissected glaciated mountain slopes, dry

This map unit is on dissected glaciated mountain slopes. Elevation ranges from 3,000 to 5,000 feet. The vegetation consists of dry, mixed forest. The soils formed in compact glacial till and material weathered from metasedimentary rocks.

Landform

The dominant slopes are on southerly aspects and have gradients of 30 to 60 percent. The dissected

glaciated mountain slopes have a thin mantle of glacial till. The drainage pattern consists of closely spaced, parallel first-order drainageways. The drainageways flow into third- or fourth-order streams. They are moderately incised with V-shaped valleys. Landslides can occur in the drainageways.

Vegetation

The vegetation is a mixed forest of Douglas-fir and ponderosa pine. Lodgepole pine and western larch are included along draws and at the higher elevations. The forest understory is dominated by shrubs. Pinegrass is common.

Habitat Types

Douglas-fir/pinegrass is the major habitat type. Douglas-fir/ninebark and Douglas-fir/twinflower are similar habitat types. These habitat types are in about 85 percent of the unit.

Dissimilar habitat types are in about 15 percent of the unit. Subalpine fir/beargrass is at the higher elevations. Its productivity for timber is lower than that of the major habitat type. Western hemlock/queencup beadlily and western redcedar/queencup beadlily grow along drainageways. Their productivity is higher than that of the major habitat type.

Geology

This map unit is underlain by argillite, siltite, and quartzite of the Belt supergroup. Thin deposits of dense, brittle glacial till overlie the bedrock in places.

Characteristics of the Soils

These soils have a surface layer of loess that has been influenced by volcanic ash. The surface layer is 4 to 14 inches thick. It is medium textured or moderately coarse textured. The soils are not easily identified by unique landscape features. They are either 4 to 20 inches deep over bedrock or 20 to 60 inches deep over bedrock.

Map Unit Composition

The dominant soils are loamy-skeletal, mixed, frigid Typic Ustochrepts and loamy-skeletal, mixed, frigid Lithic Ustochrepts.

The Typic Ustochrepts are 20 to 60 inches deep over bedrock. They have a surface layer of loess 4 to 7 inches thick. The content of rock fragments in their subsoil ranges from 35 to 50 percent. The similar soils have a surface layer of loess 7 to 14 inches thick or have a content of rock fragments in the subsoil that ranges from 20 to 35 percent. They are loamy-skeletal, mixed, frigid Andic Ustochrepts and coarse-loamy, mixed, frigid Typic Ustochrepts. These dominant and similar soils make up about 60 percent of the unit.

The Lithic Ustochrepts are 4 to 20 inches deep over bedrock. They make up about 30 percent of the unit.

The components of this unit occur in areas so intricately mixed that it was not practical to map them separately at the scale used.

Rock outcrop is a dissimilar inclusion on the upper slopes and ridgetops. It makes up about 10 percent of the unit.

Representative Profile of the Soils

The dominant Typic Ustochrepts have a dark gray very gravelly very fine sandy loam surface layer about 8 inches thick. The subsoil is gray very gravelly very fine sandy loam about 19 inches thick. The substratum is gray very gravelly very fine sandy loam. Bedrock is at a depth of about 45 inches.

The Lithic Ustochrepts have a surface layer of brown very cobbly sandy loam. The surface layer is about 6 inches thick. The upper part of the subsoil is light yellowish brown very cobbly sandy loam about 6 inches thick. The lower part is light brownish gray extremely cobbly fine sandy loam. Bedrock is at a depth of about 19 inches.

Management

Timber

The potential annual production is low. The depth to bedrock limits productivity. The slope limits the operation of tractors. Regeneration of the forest is limited by solar insolation and plant competition. The pinegrass competes vigorously with tree seedlings in open areas. Rotting wood is an important source of nitrogen in this unit. Leaving large diameter slash on the site after logging helps to maintain fertility. Trees are susceptible to windthrow in areas where the depth to bedrock is limited.

Roads

The hard rock frequently limits excavation during road construction. If the hard rock is excavated, the cut and fill material is extremely stony and has a low water-holding capacity. Material exposed in cutbanks during road construction tends to slough if the cutbanks are steep. It is difficult to revegetate because of moisture stress. Surface crusting limits revegetation in areas where the substratum has been exposed during construction. Seeding these areas as soon as possible after construction helps to ensure successful revegetation. The closely spaced, deeply incised drainageways increase the amount of material that is excavated during road construction. The frequency of landslides in drainageways may increase because of the roads. Tread erosion tends to remove fine textured material from unsurfaced roads. The remaining gravel and cobbles form a rough surface.

Watershed

The hazard of erosion is moderate along skid trails and fire lines and in areas where soil material has been exposed by road construction. Sediment delivery efficiency is high.

Wildlife and fisheries

This map unit can provide habitat for big game in winter. The vegetation is commonly old growth forest.

Recreation and visual quality

Driving for pleasure, hiking, and gathering wood are common recreational activities in areas of this map unit. Maintaining the visual quality of the unit is difficult because roadcuts on steep slopes are obtrusive if they are not vegetated.

401—Rock outcrop-Andic Cryochrepts-Lithic Cryochrepts complex, glacial trough walls

This map unit is on glacial trough walls. Elevation ranges from 4,200 to 8,000 feet. The vegetation consists of subalpine forest. The soils formed in material weathered from metasedimentary rocks and friable glacial till.

Landform

The dominant slopes have gradients of 60 to 80 percent. The glacial trough walls are the valley walls of U-shaped glaciated valleys. They have straight slopes on the upper half of the valley wall and concave slopes on the lower half. The map unit includes many avalanche paths with small debris fans at the base of the paths. The drainage pattern consists of closely spaced, slightly incised, parallel first-order drainageways.

Vegetation

The vegetation is a mixed forest of subalpine fir, spruce, and whitebark pine with many avalanche paths supporting alder and menziesia. The forest understory is dominated by shrubs.

Habitat Types

This unit includes a complex of habitat types and shrub community types. Subalpine fir/beargrass is the major habitat type. Subalpine fir/grouse whortleberry, mountain hemlock/beargrass, and mountain hemlock/menziesia are similar habitat types. These habitat types are in about 25 percent of the forested part of the unit.

Alder and menziesia community types are in avalanche paths. They are in about 20 percent of the unit.

Dissimilar habitat types are in about 15 percent of the forested part of the unit. Subalpine fir/menziesia and subalpine fir/Sitka alder are on northerly aspects and the lower slopes. Their productivity for timber is higher than that of the major habitat type.

Geology

This map unit is underlain by argillite, siltite, and quartzite of the Belt supergroup. Friable deposits of glacial till mantle the bedrock in places.

Characteristics of the Soils

The soils in this map unit have a surface layer of loess that has been influenced by volcanic ash. The surface layer is 4 to 14 inches thick. It is medium textured. The content of angular rock fragments in the subsoil ranges from 45 to 60 percent. The soil properties vary with aspect and slope position of the soils. The soils on northerly aspects and the lower slopes are 20 to 60 inches deep over bedrock. The soils on southerly aspects and the upper slopes are 4 to 20 inches deep over bedrock.

Map Unit Composition

The Rock outcrop is on the upper slopes. It makes up about 40 percent of the unit.

The dominant soils are loamy-skeletal, mixed Andic Cryochrepts and loamy-skeletal, mixed Lithic Cryochrepts.

The Andic Cryochrepts are on northerly aspects and the lower slopes, are 20 to 60 inches deep over bedrock, and have a surface layer of loess 7 to 14 inches thick. The similar soils have a surface layer of loess 4 to 7 inches thick. They are loamy-skeletal, mixed Typic Cryochrepts. These dominant and similar soils make up about 35 percent of the unit.

The Lithic Cryochrepts are on southerly aspects and the upper slopes and are 4 to 20 inches deep over bedrock. They make up about 25 percent of the unit.

The components of this unit occur in areas so intricately mixed that it was not practical to map them separately at the scale used.

Representative Profile of the Soils

The Andic Cryochrepts have a surface layer of dark brown silt loam about 8 inches thick. The upper part of the subsoil is yellowish brown very stony silt loam about 8 inches thick. The lower part is light olive brown very stony silt loam about 25 inches thick. The substratum to a depth of 60 inches or more is dark grayish brown very stony sandy loam.

The Lithic Cryochrepts have a surface layer of yellowish brown stony silt loam about 8 inches thick. The subsoil is pale brown very stony silt loam. Bedrock is at a depth of about 19 inches.

Management

Timber

This map unit contains only scattered stands of trees. It is poorly suited to woodland managed for timber.

Roads

The slope increases the amount of material that is excavated during road construction. The hard rock frequently limits excavation. If the hard rock is excavated, the cut and fill material is extremely stony and has a low water-holding capacity. Unsurfaced roads are rough because of large stones or cobbles. Large stones can roll from roadcuts onto road surfaces causing a driving hazard. Material exposed during road construction is difficult to revegetate because of moisture stress. Avalanches can increase the cost of maintaining the roads.

Watershed

The material exposed by road construction has a slight hazard of erosion. Sediment delivery efficiency is high.

Wildlife and fisheries

This map unit can provide habitat for mountain goat and mule deer in summer. It provides important food sources for grizzly bears in spring.

Recreation and visual quality

This map unit provides scenic views for travelers on roads in the adjacent valley bottoms. Maintaining the visual quality of the unit is very difficult because roadcuts on steep slopes are obtrusive if they are not vegetated.

403—Rock outcrop-Lithic Cryochrepts-Andic Cryochrepts complex, cirque headwalls and alpine ridges

This map unit is on cirque headwalls and alpine ridges. Elevation ranges from 5,500 to 8,700 feet. The vegetation consists of subalpine forest. The soils formed in material weathered from metasedimentary rocks and friable glacial till.

Landform

The dominant slopes have gradients of 40 to 80 percent. The cirque headwalls are the dominant landform. They are generally on northerly aspects. They have nearly vertical upper slopes and concave lower slopes, some of which contain lakes. The alpine ridges are generally on southerly aspects. The cirque headwalls and alpine ridges have no surface drainage pattern.

Vegetation

The vegetation is a mixed forest of subalpine fir, Engelmann spruce, lodgepole pine, whitebark pine, and subalpine larch. The forest understory is dominated by forbs and low-growing shrubs. Beargrass is common.

Habitat Types

Subalpine fir/beargrass is the major habitat type. Mountain hemlock/beargrass, mountain hemlock/menziesia, whitebark pine/subalpine fir, and alpine larch/subalpine fir are similar habitat types. These habitat types are in about 85 percent of the forested part of the unit.

Subalpine fir/menziesia, which is a dissimilar habitat type, is in about 15 percent of the forested part of the unit. It is on northerly aspects and in cirque basins. Its productivity for timber is higher than that of the major habitat type.

Geology

This map unit is underlain by argillite, siltite, and quartzite of the Belt supergroup. Thin deposits of friable glacial till overlie the bedrock in places.

Characteristics of the Soils

The soils in this map unit have a surface layer of loess that has been influenced by volcanic ash. The surface layer is 4 to 14 inches thick. It is medium textured. The content of angular rock fragments in the subsoil ranges from 45 to 60 percent. The soils are not easily identified by unique landscape features. They are either 4 to 20 inches deep over bedrock or 20 to 40 inches deep over bedrock.

Map Unit Composition

The Rock outcrop is on the glacial cirque headwalls. It makes up about 60 percent of the unit.

The dominant soils are loamy-skeletal, mixed Lithic Cryochrepts and loamy-skeletal, mixed Andic Cryochrepts.

The Lithic Cryochrepts are 4 to 20 inches deep over bedrock. They make up about 25 percent of the unit.

The Andic Cryochrepts are 20 to 40 inches deep over bedrock. They have a surface layer of loess 7 to 14 inches thick. The similar soils have a surface layer of loess 4 to 7 inches thick. They are loamy-skeletal, mixed Typic Cryochrepts. These dominant and similar soils make up about 15 percent of the unit.

Representative Profile of the Soils

The Lithic Cryochrepts have a surface layer of yellowish brown stony silt loam about 8 inches thick. The subsoil is pale brown very stony silt loam. Bedrock is at a depth of about 19 inches.

The Andic Cryochrepts have a surface layer of dark

brown silt loam about 8 inches thick. The upper part of the subsoil is yellowish brown very stony silt loam about 8 inches thick. The lower part is light olive brown very stony silt loam. Bedrock is at a depth of about 30 inches.

Management

Timber

This map unit contains only scattered stands of trees. It is poorly suited to woodland managed for timber.

Roads

The slope increases the amount of material that is excavated during road construction. The hard rock frequently limits excavation. If the hard rock is excavated, the cut and fill material is extremely stony and has a low water-holding capacity. Unsurfaced roads are rough because of large stones or cobbles. Large stones can roll from roadcuts onto road surfaces causing a driving hazard. Material exposed during road construction is difficult to revegetate because of moisture stress. Avalanches can increase the cost of maintaining the roads.

Watershed

The material exposed by road construction has a slight hazard of erosion. Sediment delivery efficiency is high.

Wildlife and fisheries

This map unit can provide good habitat for mountain goat and mule deer in summer. In places it can provide food sources for grizzly bears.

Recreation and visual quality

Camping, fishing, hiking, and cross-country skiing are common recreational activities in this map unit. Maintaining the visual quality of the unit is very difficult because roadcuts on very steep slopes are obtrusive if they are not vegetated.

404—Andic Cryochrepts, moraines, steep

This map unit is on moraines. Elevation ranges from 4,500 to 6,500 feet. The vegetation consists of moist, mixed forest. The soils formed in friable glacial till.

Landform

The dominant slopes have gradients of 15 to 45 percent. The moraines are hummocky deposits of glacial till. They have a deranged drainage pattern.

Vegetation

The vegetation is a mixed forest of subalpine fir, western hemlock, Douglas-fir, western larch, lodgepole pine, Engelmann spruce, mountain hemlock, and western white pine. The forest understory is dominated by shrubs and forbs. Menziesia is common.

Habitat Types

Subalpine fir/queencup beadlily is the major habitat type. Subalpine fir/menziesia, western hemlock/queencup beadlily, and subalpine fir/blue huckleberry are similar habitat types. These habitat types are in about 85 percent of the unit.

Dissimilar habitat types are in about 15 percent of the unit. Mountain hemlock/menziesia, subalpine fir/beargrass, and mountain hemlock/beargrass are on southerly aspects. Their productivity for timber is lower than that of the major habitat type.

Geology

These soils are underlain by friable glacial till.

Characteristics of the Soils

These soils have a surface layer of loess that has been influenced by volcanic ash. The surface layer is 4 to 14 inches thick. It is medium textured. The content of rounded rock fragments in the subsoil ranges from 45 to 60 percent.

Map Unit Composition

The dominant soils are loamy-skeletal, mixed Andic Cryochrepts. They have a surface layer of loess 7 to 14 inches thick. The similar soils have a surface layer of loess 4 to 7 inches thick. They are loamy-skeletal, mixed Typic Cryochrepts. The dominant and similar soils make up 100 percent of the map unit.

Representative Profile of the Soils

The dominant soils have a surface layer of dark brown silt loam about 8 inches thick. The upper part of the subsoil is yellowish brown very stony silt loam about 8 inches thick. The lower part is light olive brown very stony silt loam about 25 inches thick. The substratum to a depth of 60 inches or more is dark grayish brown very stony sandy loam.

Management

Timber

The potential annual production is high. Productivity on the site is highly dependent on the loess surface layer. If tractors are operated on the site, productivity can be lowered because the loess surface layer can become compacted or be displaced or it can be mixed with subsoil material.

Roads

Material exposed in cutbanks during road construction tends to ravel if the cutbanks are steep. Tread erosion tends to remove fine textured material from unsurfaced roads. The remaining gravel and

cobbles form a rough surface. Unsurfaced roads are rough because of large stones or cobbles.

Watershed

The hazard of erosion is moderate along skid trails and fire lines and in areas where soil material has been exposed by road construction. Sediment delivery efficiency is low.

Wildlife and fisheries

This map unit can provide habitat for mule deer and elk in summer. In places it provides food sources for grizzly bears. The streams provide spawning habitat for cutthroat trout and some rainbow trout.

Recreation and visual quality

Hiking, hunting, fishing, picking berries, and participating in various winter sports are common recreational activities in areas of this map unit. Maintaining the visual quality of the unit is relatively easy.

405—Lithic Cryochrepts-Andic Cryochrepts-Rock outcrop complex, glaciated mountain ridges

This map unit is on glaciated mountain ridges. Elevation ranges from 5,500 to 8,000 feet. The vegetation consists of subalpine forest. The soils formed in material weathered from metasedimentary rocks and friable glacial till.

Landform

The dominant slopes have gradients of 15 to 50 percent. The glaciated mountain ridges are convex and contain many small lakes. There is no surface drainage pattern.

Vegetation

The vegetation is a mixed forest of stunted mountain hemlock, subalpine fir, subalpine larch, and whitebark pine. The forest understory is dominated by forbs and low-growing shrubs.

Habitat Types

Mountain hemlock/beargrass is the major habitat type. Mountain hemlock/menziesia, alpine larch/subalpine fir, and white bark pine/subalpine fir are similar habitat types. These habitat types are in about 85 percent of the forested part of the unit.

Dissimilar habitat types are in about 15 percent of the forested part of the unit. Subalpine fir/menziesia is near lakes, and subalpine fir/beargrass and subalpine fir/grouse whortleberry are at the lower elevations. Their productivity for timber is higher than that of the major habitat type.

Geology

This map unit is underlain by argillite, siltite, and quartzite of the Belt supergroup. Friable glacial till overlies the bedrock in some places.

Characteristics of the Soils

The soils in this map unit have a surface layer of loess that has been influenced by volcanic ash. The surface layer is 4 to 14 inches thick. It is medium textured. The content of angular rock fragments in the subsoil ranges from 45 to 60 percent. The soils are not easily identified by unique landscape features. They are either 4 to 20 inches deep over bedrock or 20 to 60 inches deep over bedrock.

Map Unit Composition

The dominant soils are loamy-skeletal, mixed Lithic Cryochrepts and loamy-skeletal, mixed Andic Cryochrepts.

The Lithic Cryochrepts are 4 to 20 inches deep over bedrock. They make up about 50 percent of the unit.

The Andic Cryochrepts are 20 to 60 inches deep over bedrock. They have a surface layer of loess 7 to 14 inches thick. The similar soils have a surface layer of loess 4 to 7 inches thick. They are loamy-skeletal, mixed Typic Cryochrepts. These dominant and similar soils make up about 30 percent of the unit.

The Rock outcrop is in areas throughout the map unit. Rubble land, which is similar to Rock outcrop, is also included. The Rock outcrop and rubble land make up about 20 percent of the unit.

The components of this unit occur in areas so intricately mixed that it was not practical to map them separately at the scale used.

Representative Profile of the Soils

The Lithic Cryochrepts have a surface layer of yellowish brown stony silt loam about 8 inches thick. The subsoil is pale brown very stony silt loam. Bedrock is at a depth of about 19 inches.

The Andic Cryochrepts have a surface layer of dark brown silt loam about 8 inches thick. The upper part of the subsoil is yellowish brown very stony silt loam about 8 inches thick. The lower part is light olive brown very stony silt loam about 25 inches thick. The substratum to a depth of 60 inches or more is dark grayish brown very stony sandy loam.

Management

Timber

The potential annual production is very low in forested areas. The productivity is limited by the depth to bedrock. The productivity in the map unit is limited by the Rock outcrop. The slope limits the operation of tractors in part of the unit. A combination of tractor and

cable logging systems helps to overcome the slope. Productivity on the site is highly dependent on the loess surface layer. If tractors are operated on the site, productivity can be lowered because the loess surface layer can become compacted or be displaced or it can be mixed with subsoil material. Regeneration of the forest is limited by the harsh subalpine climate. Trees growing on shallow soils are susceptible to windthrow.

Roads

The hard rock frequently limits excavation during road construction. Unsurfaced roads are rough because of large stones or cobbles. Material exposed during road construction is difficult to revegetate because of the harsh subalpine climate.

Watershed

Erosion is a moderate hazard along skid trails and fire lines. The material exposed by road construction has a slight hazard of erosion. Sediment delivery efficiency is low.

Wildlife and fisheries

This map unit can provide habitat for mule deer and mountain goats in summer. It also can provide food sources and denning sites for grizzly bears. The gentle slopes can provide habitat for elk in summer.

Recreation and visual quality

Fishing, camping, and winter sports are common recreational activities in areas of this map unit. Maintaining the visual quality of the unit is difficult following road construction because revegetating roadcuts is difficult.

406—Andic Cryochrepts, glaciated mountain ridges

This map unit is on glaciated mountain ridges. Elevation ranges from 5,000 to 6,500 feet. The vegetation consists of subalpine forest. The soils formed in material weathered from metasedimentary rocks and friable glacial till.

Landform

The dominant slopes have gradients of 15 to 50 percent. The glaciated mountain ridges contain many small lakes. The drainage pattern is dendritic. The drainageways are first order and are widely spaced.

Vegetation

The vegetation is a mixed forest of subalpine fir, Engelmann spruce, lodgepole pine, mountain hemlock, and western larch. The forest understory is dominated by forbs and low-growing shrubs.

Habitat Types

Subalpine fir/beargrass is the major habitat type. Subalpine fir/grouse whortleberry, subalpine fir/wood-rush, mountain hemlock/menziesia, and mountain hemlock/beargrass are similar habitat types. These habitat types are in about 85 percent of the unit.

Dissimilar habitat types are in about 15 percent of the unit. Subalpine fir/menziesia and subalpine fir/queencup beadlily are at the lower elevations. Their productivity for timber is higher than that of the major habitat type.

Geology

This map unit is underlain by argillite, siltite, and quartzite of the Belt supergroup. Friable glacial till overlies the bedrock in some places.

Characteristics of the Soils

These soils have a surface layer of loess that has been influenced by volcanic ash. The surface layer is 4 to 14 inches thick. It is medium textured. The content of angular rock fragments in the subsoil ranges from 45 to 60 percent.

Map Unit Composition

The dominant soils are loamy-skeletal, mixed Andic Cryochrepts. They have a surface layer of loess 7 to 14 inches thick. The similar soils have a surface layer of loess 4 to 7 inches thick. They are loamy-skeletal, mixed Typic Cryochrepts. The dominant and similar soils make up about 85 percent of the unit.

Rock outcrop and dissimilar soils make up about 15 percent of the unit. They are on ridgetops. The dissimilar soils are loamy-skeletal, mixed Lithic Cryochrepts. They are 4 to 20 inches deep over bedrock. Their productivity for timber is lower than that of the dominant soils.

Representative Profile of the Soils

The dominant soils have a surface layer of dark brown silt loam about 8 inches thick. The upper part of the subsoil is yellowish brown very stony silt loam about 8 inches thick. The lower part is light olive brown very stony silt loam about 25 inches thick. The substratum to a depth of 60 inches or more is dark grayish brown very stony sandy loam.

Management

Timber

The potential annual production is low. The slope limits the operation of tractors in some areas. A combination of tractor and cable logging systems helps to overcome the slope. Soil productivity is highly dependent on the loess surface layer. If tractors are operated on the site, productivity can be lowered

because the loess surface layer can become compacted or be displaced or it can be mixed with subsoil material. Regeneration of the forest is limited by the harsh subalpine climate.

Roads

Material exposed in cutbanks during road construction tends to ravel if the cutbanks are steep. It is difficult to revegetate because of the harsh subalpine climate.

Watershed

Erosion is a moderate hazard along skid trails and fire lines. The material exposed by road construction has a slight hazard of erosion. Sediment delivery efficiency is low.

Wildlife and fisheries

This map unit can provide habitat for mule deer and mountain goats in summer. It also can provide food sources and denning sites for grizzly bears.

Recreation and visual quality

Hunting, participating in various winter sports, and sightseeing by car are common recreational activities in areas of this map unit. Maintaining the visual quality of the unit is difficult because roadcuts are difficult to revegetate.

407—Andic Cryochrepts, moraines

This map unit is on moraines. Elevation ranges from 3,000 to 5,500 feet. The vegetation consists of moist, mixed forest. The soils formed in friable glacial till.

Landform

The dominant slopes have gradients of 5 to 20 percent. The moraines are on the bottom of U-shaped glacial valleys. They have no integrated drainage pattern. Streams originating at the higher elevations flow through these valleys.

Vegetation

The vegetation is a mixed forest of subalpine fir, Engelmann spruce, lodgepole pine, Douglas-fir, western larch, and western white pine. The forest understory is dominated by shrubs and forbs. Menziesia is common.

Habitat Types

Subalpine fir/menziesia is the major habitat type. Subalpine fir/queencup beadlily is a similar habitat type. These habitat types are in about 85 percent of the unit.

Dissimilar habitat types are in about 15 percent of the unit. Mountain hemlock/menziesia and subalpine fir/woodrush are at the higher elevations. Their productivity for timber is lower than that of the major habitat type. Subalpine fir/devil's club grows on wet soils along the streams.

Geology

These soils are underlain by friable glacial till.

Characteristics of the Soils

These soils have a surface layer of loess that has been influenced by volcanic ash. The surface layer is 7 to 18 inches thick. It is medium textured. The content of rounded rock fragments in the subsoil ranges from 45 to 60 percent.

Map Unit Composition

The dominant soils are loamy-skeletal, mixed Andic Cryochrepts. They have a surface layer of loess 7 to 14 inches thick. The similar soils have a surface layer of loess 14 to 18 inches thick. They are medial over loamy-skeletal, mixed Entic Cryandepts. The dominant and similar soils make up about 90 percent of the unit.

Dissimilar soils make up about 10 percent of the unit. They are loamy-skeletal, mixed Andic Cryumbrepts. They are along streams. They have a dark surface layer and a water table that fluctuates.

Representative Profile of the Soils

The dominant soils have a surface layer of dark brown silt loam about 8 inches thick. The upper part of the subsoil is yellowish brown very stony silt loam about 8 inches thick. The lower part is light olive brown very stony silt loam about 25 inches thick. The substratum to a depth of 60 inches or more is dark grayish brown very stony sandy loam.

Management

Timber

The potential annual production is high. Productivity on the site is highly dependent on the loess surface layer. If tractors are operated on the site, productivity can be lowered because the loess surface layer can become compacted or be displaced or it can be mixed with subsoil material. Regeneration of the forest is limited by frost pockets in low areas and by plant competition. Menziesia competes vigorously with tree seedlings in open areas.

Roads

Material exposed in cutbanks during road construction tends to ravel if the cutbanks are steep. Unsurfaced roads are rough because of large stones or cobbles. Tread erosion tends to remove fine textured material from unsurfaced roads. The remaining gravel and cobbles form a rough surface.

Watershed

The major concern of watershed management is the

protection of streambanks and channels. Carefully locating bridges and culverts helps to maintain the stability of the channels. Changes in the channel can result in a large amount of sediment. Disturbing the soils on or adjacent to the streambanks can result in severe sedimentation. The hazard of erosion is moderate along skid trails and fire lines and in areas where soil material has been exposed by road construction. Sediment delivery efficiency is high.

Wildlife and fisheries

This map unit can provide habitat for elk in summer. It commonly provides food sources for grizzly bears. The vegetation commonly is old growth forest. The streams provide spawning habitat for trout and whitefish.

Recreation and visual quality

Hunting, camping, gathering wood, picking berries, and cross-country skiing are common recreational activities in areas of this map unit. Maintaining the visual quality of the unit is relatively easy.

408—Andic Cryochrepts-Rock outcrop complex, glaciated mountain slopes, very steep

This map unit is on very steep glaciated mountain slopes. Elevation ranges from 3,000 to 5,500 feet. The vegetation consists of moist, mixed forest. The soils formed in material weathered from metasedimentary rocks or friable glacial till.

Landform

The dominant slopes have gradients of 60 to 80 percent. The very steep glaciated mountain slopes are on valley side slopes along the larger glacial valleys. They are commonly the truncated spur ridges of tributary valleys. Slopes are straight and smooth. The drainage pattern is parallel, and drainageways are closely spaced.

Vegetation

The vegetation is a mixed forest of subalpine fir, western hemlock, Engelmann spruce, grand fir, western larch, western white pine, Douglas-fir, and lodgepole pine. The forest understory is dominated by shrubs and forbs.

Habitat Types

Subalpine fir/queencup beadlily is the major habitat type. Western hemlock/queencup beadlily and subalpine fir/menziesia are similar habitat types. These habitat types are in about 85 percent of the forested part of the unit.

Dissimilar habitat types are in about 15 percent of the forested part of the unit. Subalpine fir/beargrass is at the higher elevations, and Douglas-fir/ninebark is at the lower elevations. Their productivity for timber is lower than that of the major habitat type.

Geology

This map unit is underlain by argillite, siltite, and quartzite of the Belt supergroup. Thin deposits of friable glacial till overlie the bedrock in places.

Characteristics of the Soils

The soils in this map unit have a surface layer of loess that has been influenced by volcanic ash. The surface layer is 7 to 18 inches thick. It is medium textured. The content of angular rock fragments in the subsoil ranges from 45 to 60 percent.

Map Unit Composition

The dominant soils are loamy-skeletal, mixed Andic Cryochrepts. They have a surface layer of loess 7 to 14 inches thick. The similar soils have a surface layer of loess 14 to 18 inches thick. They are medial over loamy-skeletal, mixed Entic Cryandepts. The dominant and similar soils make up about 75 percent of the unit.

The Rock outcrop is on the upper slopes. It makes up about 15 percent of the unit.

The components of this unit occur in areas so intricately mixed that it was not practical to map them separately at the scale used.

Dissimilar soils make up about 10 percent of the unit. They are loamy-skeletal, mixed Lithic Cryochrepts. They are on the upper slopes in areas near the Rock outcrop. They are 4 to 20 inches deep over bedrock. Their productivity for timber is lower than that of the dominant soils.

Representative Profile of the Soils

The dominant soils have a surface layer of dark brown silt loam about 8 inches thick. The upper part of the subsoil is yellowish brown very stony silt loam about 8 inches thick. The lower part is light olive brown very stony silt loam about 25 inches thick. The substratum to a depth of 60 inches or more is dark grayish brown very stony sandy loam.

Management

Timber

The potential annual production is high in forested areas. Productivity in the map unit is limited by the Rock outcrop. The slope severely limits the operation of tractors. Cable logging systems are safer and disturb the soil less than tractor logging systems.

Roads

The slope increases the amount of material that is

excavated during road construction. The hard rock frequently limits excavation. If the hard rock is excavated, the cut and fill material is extremely stony and has a low water-holding capacity. Unsurfaced roads are rough because of large stones or cobbles. Large stones can roll from roadcuts onto road surfaces causing a driving hazard. Material exposed during road construction is difficult to revegetate because of moisture stress.

Watershed

Erosion is a moderate hazard along skid trails and fire lines. The material exposed by road construction has a slight hazard of erosion. Sediment delivery efficiency is high.

Wildlife and fisheries

In places this map unit provides old growth forest habitat.

Recreation and visual quality

This map unit does not provide opportunities for common recreational activities. Maintaining the visual quality of the unit is difficult because roadcuts on steep slopes are obtrusive if they are not vegetated.

502—Typic Ustochrepts, mountain slopes, south aspects

This map unit is on mountain slopes. Elevation ranges from 2,800 to 4,500 feet. The vegetation consists of dry, mixed forest. The soils formed in material weathered from metasedimentary rocks.

Landform

The dominant slopes are on southerly aspects and have gradients of 35 to 60 percent. The mountain slopes are slightly convex on the upper half and linear on the lower half. The drainage pattern is dendritic, and drainageways are moderately incised.

Vegetation

The vegetation is a mixed forest of Douglas-fir and ponderosa pine. The forest understory is dominated by shrubs. Pinegrass is common.

Habitat Types

Douglas-fir/ninebark is the major habitat type. Douglas-fir/snowberry is a similar habitat type. These habitat types are in about 85 percent of the unit.

Douglas-fir/bluebunch wheatgrass, which is a dissimilar habitat type, is in about 15 percent of the unit. It is on ridgetops. Its productivity for timber is lower than that of the major habitat type.

Geology

This map unit is underlain by argillite, siltite, and quartzite of the Belt supergroup. These rocks produce medium textured and moderately coarse textured material when weathered.

Characteristics of the Soils

These soils have a medium textured surface layer. The content of angular rock fragments in the subsoil ranges from 50 to 70 percent.

Map Unit Composition

The dominant soils are loamy-skeletal, mixed, frigid Typic Ustochrepts. They make up about 85 percent of the unit.

Rock outcrop and dissimilar soils make up about 15 percent of the unit. They are on the edge of ridges. The dissimilar soils are loamy-skeletal, mixed, frigid Lithic Ustochrepts. They are 4 to 20 inches deep over bedrock. Their productivity for timber is lower than that of the dominant soils.

Representative Profile of the Soils

The dominant soils have a surface layer of dark gray very gravelly very fine sandy loam about 8 inches thick. The subsoil is gray very gravelly very fine sandy loam about 19 inches thick. The substratum is gray very gravelly very fine sandy loam. Bedrock is at a depth of about 45 inches.

Management

Timber

The potential annual production is moderate. Solar insolation limits productivity. The slope limits the operation of tractors. Regeneration of the forest is limited by the solar insolation and plant competition. The pinegrass competes vigorously with tree seedlings in open areas. Rotting wood is an important source of nitrogen in this unit. Leaving large diameter slash on the site after logging helps to maintain fertility.

Roads

Material exposed during road construction is difficult to revegetate because of moisture stress.

Watershed

The hazard of erosion is slight along skid trails and fire lines and in areas where the soil material has been exposed by road construction. Sediment delivery efficiency is moderate.

Wildlife and fisheries

This map unit can provide habitat for elk and mule deer in winter and early spring. It is at the lower elevations where the depth of snow seldom limits access to food sources.

Recreation and visual quality

Hunting, sightseeing by car, and viewing wildlife are common recreational activities in areas of this map unit. Maintaining the visual quality of the unit is difficult because roadcuts are obtrusive if they are not vegetated.

503—Rock outcrop-Lithic Ustochrepts complex, south aspects

This map unit is on mountain slopes. Elevation ranges from 3,000 to 5,000 feet. The vegetation consists of open-grown forest. The soils formed in material weathered from metasedimentary rocks.

Landform

The dominant slopes are on southerly aspects and have gradients of 35 to 55 percent. The mountain slopes are slightly convex on the upper half and linear on the lower half. The drainage pattern is dendritic.

Vegetation

The vegetation is scattered stands of Douglas-fir and ponderosa pine. The forest understory is dominated by bunchgrasses mixed with shrubs and forbs.

Habitat Types

Douglas-fir/bluebunch wheatgrass is the major habitat type. It occupies about 85 percent of the forested part of the unit.

Dissimilar habitat types are in about 15 percent of the forested part of the unit. Douglas-fir/ninebark and Douglas-fir/pinegrass are in depressions in areas of included deep soils. Their productivity for timber is higher than that of the major habitat type. Forested scree community types are in areas of the Rock outcrop and talus.

Geology

This map unit is underlain by argillite, siltite, and quartzite of the Belt supergroup. These rocks produce medium textured and moderately coarse textured material when weathered.

Characteristics of the Soils

The soils in this map unit are 4 to 20 inches deep over bedrock. They have a medium textured and moderately coarse textured surface layer. The content of angular rock fragments in the subsoil ranges from 50 to 70 percent.

Map Unit Composition

The Rock outcrop is in areas throughout the map unit. It makes up about 50 percent of the unit.

The dominant soils are loamy-skeletal, mixed, frigid Lithic Ustochrepts. They are in areas throughout the unit. They make up about 40 percent of the unit.

The components of this unit occur in areas so intricately mixed that it was not practical to map them separately at the scale used.

Dissimilar soils make up about 10 percent of the unit. They are loamy-skeletal, mixed, frigid Typic Ustochrepts. They are on the lower slopes and in depressions. They are 20 to 60 inches deep over bedrock. Their productivity is higher than that of the dominant soils.

Representative Profile of the Soils

The dominant soils have a surface layer of brown very fine sandy loam and very cobbly sandy loam about 6 inches thick. The upper part of the subsoil is light yellowish brown very cobbly sandy loam about 6 inches thick. The lower part is light brownish gray extremely cobbly fine sandy loam. Bedrock is at a depth of about 19 inches.

Management

Timber

The potential annual production is very low. The productivity is limited by the depth to bedrock. The productivity in the map unit is limited by the Rock outcrop. The slope limits the operation of tractors. Regeneration of the forest is limited by solar insolation. Trees growing on shallow soils are susceptible to windthrow.

Roads

The hard rock frequently limits excavation during road construction. If the hard rock is excavated, the cut and fill material is extremely stony and has a low water-holding capacity. Unsurfaced roads are rough because of large stones or cobbles. Material exposed during road construction is difficult to revegetate because of moisture stress.

Watershed

The hazard of erosion is slight along skid trails and fire lines and in areas where soil material has been exposed by road construction. Sediment delivery efficiency is moderate.

Wildlife and fisheries

This map unit can provide habitat for elk and mule deer in winter and early spring.

Recreation and visual quality

Hiking, hunting, and photographing wild flowers are common recreational activities in areas of this map unit. Maintaining the visual quality of the unit is very difficult because the forest cover is sparse and because revegetating roadcuts is difficult.

510—Typic Calcixerolls, south aspects

This map unit is on mountain slopes. Elevation ranges from 3,000 to 4,500 feet. The vegetation consists of open-grown forest. The soils formed in material weathered from metasedimentary rocks.

Landform

The dominant slopes are on southerly aspects and have gradients of 15 to 50 percent. The mountain slopes are slightly convex on the upper half and linear on the lower half. The drainage pattern is dendritic. The drainageways are slightly incised and are swalelike in appearance.

Vegetation

The vegetation is scattered stands of Douglas-fir and ponderosa pine. The forest understory is dominated by bunchgrasses mixed with shrubs and forbs.

Habitat Types

Douglas-fir/bluebunch wheatgrass is the major habitat type. Ponderosa pine/bitterbrush and rough fescue/bluebunch wheatgrass are similar habitat types. These habitat types are in about 85 percent of the unit.

Dissimilar habitat types are in about 15 percent of the unit. Douglas-fir/ninebark and Douglas-fir/pinegrass are on northerly aspects. Their productivity for timber is higher than that of the major habitat type.

Geology

This map unit is underlain by argillite, siltite, quartzite, and limestone of the Belt supergroup. These rocks weather to produce calcareous, loamy material. Thin deposits of glacial till overlie the bedrock in places.

Characteristics of the Soils

These soils have a medium textured surface layer. The content of angular rock fragments in the subsoil ranges from 50 to 70 percent. In some places the subsoil or substratum is calcareous. In other places the soils are calcareous throughout.

Map Unit Composition

The dominant soils are loamy-skeletal, mixed, frigid Typic Calcixerolls. They are calcareous throughout. The similar soils have a noncalcareous surface layer. They are loamy-skeletal, mixed, frigid Calcic Haploxerolls and loamy-skeletal, mixed, frigid Typic Haploxerolls. The dominant and similar soils make up about 80 percent of the unit.

Rock outcrop and dissimilar soils are included in about 20 percent of this unit. They are on ridgetops. The dissimilar soils are loamy-skeletal, mixed, frigid Lithic Haploxerolls. They are 4 to 20 inches deep over bedrock. Their productivity for timber is lower than that of the dominant soils.

Representative Profile of the Soils

The dominant soils have a surface layer of calcareous, dark brown gravelly silt loam about 13 inches thick. The upper part of the subsoil is calcareous, light yellowish brown and light gray very gravelly silt loam about 15 inches thick. The lower part to a depth of 60 inches or more is calcareous, white and light gray very gravelly and extremely gravelly silt loam.

Management

Timber

The potential annual production is very low. Solar insolation limits productivity and regeneration. The slope limits the operation of tractors in some areas. A combination of tractor and cable logging systems helps to overcome the slope.

Roads

Material exposed during road construction is difficult to revegetate because of moisture stress.

Watershed

Erosion is a severe hazard along skid trails and fire lines. The material exposed by road construction has a slight hazard of erosion. Sediment delivery efficiency is moderate.

Wildlife and fisheries

This map unit can provide habitat for elk and mule deer in winter and early spring. It includes open areas that are used for hunting by raptors. In places it provides habitat for bear in spring. It is at the lower elevations where the depth of snow seldom limits access to food sources.

Recreation and visual quality

Hiking, hunting, and photographing wild flowers are common recreational activities in areas of this map unit. Maintaining the visual quality of the unit is difficult because the forest cover is sparse and because revegetating roadcuts is difficult.

520—Andic Dystric Eutrochrepts, micaceous substratum

This map unit is on mountain slopes. Elevation ranges from 2,700 to 4,000 feet. The vegetation consists of moist, mixed forest. The soils formed in material weathered from micaceous rocks.

Landform

The dominant slopes have gradients of 15 to 35

percent. The mountain slopes are slightly convex on the upper half and linear on the lower half. The drainage pattern is deranged.

Vegetation

The vegetation is a mixed forest of western larch, Douglas-fir, and lodgepole pine. The forest understory is dominated by mixed forbs and low-growing shrubs.

Habitat Types

Grand fir/queencup beadlily is the major habitat type. Grand fir/twinflower is a similar habitat type. These habitat types are in about 85 percent of the unit.

Douglas-fir/ninebark, which is a dissimilar habitat type, is in about 15 percent of the unit. It is on southerly aspects. Its productivity for timber is lower than that of the major habitat type.

Geology

These soils are underlain by pyroxenite. When weathered, the pyroxenite produces coarse textured material containing more than 40 percent mica.

Characteristics of the Soils

These soils have a surface layer of loess that has been influenced by volcanic ash. The surface layer is 4 to 14 inches thick. It is moderately coarse textured. The content of angular rock fragments in the subsoil and substratum ranges from 0 to 35 percent. The content of mica in the subsoil and substratum is 40 percent or more.

Map Unit Composition

The dominant soils are sandy, micaceous, frigid Andic Dystric Eutrochrepts. They have a surface layer of loess 7 to 14 inches thick. The similar soils have a surface layer of loess 4 to 7 inches thick. They are sandy, micaceous, frigid Dystric Eutrochrepts. The dominant and similar soils make up about 90 percent of the unit.

Dissimilar soils make up about 10 percent of the unit. They are loamy-skeletal, mixed, frigid Andic Dystric Eutrochrepts. They formed in glacial till deposits or material weathered from metasedimentary rocks. They have more rock fragments in the subsoil than the dominant soils, and their subsoil and substratum are less erodible.

Representative Profile of the Soils

The dominant soils have a surface layer of dark grayish brown very fine sandy loam about 9 inches thick. The upper part of the subsoil is olive very gravelly coarse sandy loam about 9 inches thick. The lower part is olive gray gravelly loamy sand about 22 inches thick. The substratum to a depth of 60 inches or more is dark yellowish brown sand.

Management

Timber

The potential annual production is high. Productivity on the site is highly dependent on the loess surface layer. If tractors are operated on the site, productivity can be lowered because the loess surface layer can become compacted or be displaced or it can be mixed with subsoil material.

Roads

Material exposed in cutbanks during road construction tends to ravel if the cutbanks are steep. Tread erosion tends to remove fine textured material from unsurfaced roads. The remaining gravel and cobbles form a rough surface. Unsurfaced roads have a loose, gravelly or cobbly sandy surface when the soils are dry.

Watershed

Erosion is a moderate hazard along skid trails and fire lines. The material exposed by road construction has a severe hazard of erosion. Sediment delivery efficiency is moderate.

Wildlife and fisheries

This map unit can provide habitat for elk and mule deer in summer. It commonly provides old growth forest and cavity nesting habitat.

Recreation and visual quality

Hunting and gathering wood are common recreational activities in areas of this map unit. Maintaining the visual quality of the unit is relatively easy.

522—Andic Dystrochrepts, granitic substratum

This map unit is on mountain slopes. Elevation ranges from 3,000 to 5,500 feet. The vegetation consists of moist, mixed forest. The soils formed in material weathered from granitic rocks.

Landform

The dominant slopes have gradients of 20 to 60 percent. The mountain slopes are slightly convex on the upper half and linear on the lower half. The drainage pattern is dendritic.

Vegetation

The vegetation is a mixed forest of western hemlock, western redcedar, Engelmann spruce, western larch, Douglas-fir, western white pine, subalpine fir, lodgepole pine, and grand fir. The forest understory is dominated by shrubs and forbs.

Habitat Types

Western hemlock/queencup beadlily and western redcedar/queencup beadlily are the major habitat types. Subalpine fir/queencup beadlily, grandfir/queencup beadlily, subalpine fir/menziesia, and subalpine fir/Sitka alder are similar habitat types. These habitat types are in 100 percent of the map unit.

Geology

These soils are underlain by granitic rocks. These rocks produce coarse textured material when weathered. They are mostly metadiorite. The material weathered from metadiorite generally has a distinctive red or green color.

Characteristics of the Soils

These soils have a surface layer of loess that has been influenced by volcanic ash. The surface layer is 7 to 18 inches thick. It is medium textured. The content of angular rock fragments in the subsoil ranges from 45 to 70 percent.

Map Unit Composition

The dominant soils are loamy-skeletal, mixed, frigid Andic Dystrochrepts. They have a surface layer of loess 7 to 14 inches thick. The similar soils have a surface layer of loess 14 to 18 inches thick. They are medial over loamy-skeletal, mixed, frigid Typic Vitrandepts. The dominant and similar soils make up about 80 percent of the unit.

Dissimilar soils make up about 20 percent of the unit. They are loamy-skeletal, mixed, frigid Andic Haplumbrepts and loamy-skeletal, mixed, frigid Lithic Dystrochrepts. The Andic Haplumbrepts are in depressions. They have a dark surface layer and a water table that fluctuates. The Lithic Dystrochrepts are on ridges. They are 4 to 20 inches deep over bedrock. Their productivity for timber is lower than that of the dominant soils.

Representative Profile of the Soils

The dominant soils are yellowish brown gravelly silt loam in the upper 7 inches of the surface layer. The lower 13 inches of the surface layer is very pale brown very gravelly very fine sandy loam. The subsoil is strong brown very gravelly very fine sandy loam about 21 inches thick. The substratum to a depth of 60 inches or more is pale brown very gravelly very fine sandy loam.

Management

Timber

The potential annual production is high. The slope limits the operation of tractors in some areas. A combination of tractor and cable logging systems helps to overcome the slope. Productivity on the site is highly dependent on the loess surface layer. If tractors are operated on the site, productivity can be lowered because the loess surface layer can become compacted or be displaced or it can be mixed with subsoil material.

Roads

Material exposed in cutbanks during road construction tends to ravel if the cutbanks are steep. Tread erosion tends to remove fine textured material from unsurfaced roads. The remaining gravel and cobbles form a rough surface. Unsurfaced roads have a loose, gravelly or cobbly sandy surface when the soils are dry. Ground water tends to concentrate near the boundary of this unit and adjacent units. Excavation near these boundaries can intercept ground water. Cutbanks tend to slough near these concentrations of ground water.

Watershed

Erosion is a moderate hazard along skid trails and fire lines. The material exposed by road construction has a severe hazard of erosion. Sediment delivery efficiency is moderate.

Wildlife and fisheries

This map unit can provide habitat for big game in summer. It commonly includes old growth forest and cavity nesting habitat. In places it provides food sources for grizzly bears. The streams provide spawning habitat for trout and whitefish.

Recreation and visual quality

Hiking, gathering wood, picking berries, and hunting are common recreational activities in areas of this map unit. Maintaining the visual quality of the unit is difficult because roadcuts on steep slopes are obtrusive if they are not vegetated.

552—Andic Dystrochrepts, mountain slopes

This map unit is on mountain slopes. Elevation ranges from 3,000 to 5,400 feet. The vegetation consists of moist, mixed forest. The soils formed in material weathered from metasedimentary rocks.

Landform

The dominant slopes are on northerly aspects and have gradients of 35 to 60 percent. The mountain slopes are slightly convex on the upper half and linear on the lower half. Small basins are at the higher elevations. First-order drainageways originate in these basins. The drainage pattern is dendritic, and drainage channels are deeply incised.

Vegetation

The vegetation is a mixed forest of western hemlock, western larch, subalpine fir, western white pine, Douglas-fir, mountain hemlock, and lodgepole pine. The forest understory is dominated by shrubs and forbs.

Habitat Types

Western hemlock/queencup beadlily and western redcedar/queencup beadlily are the major habitat types. Grand fir/queencup beadlily, subalpine fir/menziesia, and subalpine fir/queencup beadlily are similar habitat types. These habitat types are in about 85 percent of the unit.

Douglas-fir/ninebark, which is a dissimilar habitat type, is in about 15 percent of the unit. It is on southerly aspects. Its productivity for timber is lower than that of the major habitat types.

Geology

This map unit is underlain by argillite, siltite, and quartzite of the Belt supergroup. These rocks produce medium textured and moderately coarse textured material when weathered.

Characteristics of the Soils

These soils have a surface layer of loess that has been influenced by volcanic ash. The surface layer is 7 to 18 inches thick. It is medium textured. The content of angular rock fragments in the subsoil ranges from 50 to 70 percent.

Map Unit Composition

The dominant soils are loamy-skeletal, mixed, frigid Andic Dystrochrepts. They have a surface layer of loess 7 to 14 inches thick. The similar soils have a surface layer of loess 14 to 18 inches thick. They are medial over loamy-skeletal, mixed, frigid Typic Vitrandepts. The dominant and similar soils make up about 80 percent of the unit.

Rock outcrop and dissimilar soils make up about 20 percent of the unit. The dissimilar soils are loamy-skeletal, mixed, frigid Lithic Dystrochrepts and loamy-skeletal, mixed, frigid Andic Haplumbrepts. The Lithic Dystrochrepts are on the upper slopes and ridges. They are 4 to 20 inches deep over bedrock. Their productivity for timber is lower than that of the dominant soils. The Andic Haplumbrepts are in basins. They have a dark surface layer and a water table that fluctuates. The Rock outcrop is on the upper slopes and ridges.

Representative Profile of the Soils

The dominant soils are yellowish brown gravelly silt loam in the upper 7 inches of the surface layer. The lower 13 inches of the surface layer is very pale brown very gravelly very fine sandy loam. The subsoil is strong brown very gravelly very fine sandy loam about 21 inches thick. The substratum to a depth of 60 inches or more is pale brown very gravelly very fine sandy loam.

Management

Timber

The potential annual production is high. The slope limits the operation of tractors.

Roads

No major hazards or limitations affect the performance of roads if the roads are properly located and if standard construction and maintenance practices are applied.

Watershed

Erosion is a moderate hazard along skid trails and fire lines. The material exposed by road construction has a slight hazard of erosion. Sediment delivery efficiency is moderate.

Wildlife and fisheries

This map unit can provide habitat for big game in summer. It commonly includes old growth forest and cavity nesting habitat. It commonly provides food sources for grizzly bears. The streams provide spawning habitat for trout and whitefish.

Recreation and visual quality

Hunting, hiking, gathering wood, and picking berries are common recreational activities in areas of this map unit. Maintaining the visual quality of the unit is difficult because of the slope.

555—Andic Cryochrepts-Rock outcrop complex, mountain slopes

This map unit is on mountain slopes. Elevation ranges from 3,500 to 6,000 feet. The vegetation consists of moist, mixed forest. The soils formed in material weathered from metasedimentary rocks.

Landform

The dominant slopes have gradients of 25 to 50 percent. The mountain slopes are slightly convex on the upper half and linear on the lower half. The drainage pattern is dendritic. The drainageways are first and second order and frequently follow the joints and fractures of the bedrock.

Vegetation

The vegetation is a mixed forest of subalpine fir, Engelmann spruce, mountain hemlock, western larch, Douglas-fir, western white pine, and lodgepole pine. The forest understory is dominated by shrubs and forbs. Menziesia is common.

Habitat Types

Subalpine fir/menziesia is the major habitat type. Subalpine fir/queencup beadlily, subalpine fir/blue huckleberry, and mountain hemlock/menziesia are similar habitat types. These habitat types are in about 85 percent of the forested part of the unit.

Dissimilar habitat types are in about 15 percent of the forested part of the unit. Mountain hemlock/menziesia, subalpine fir/beargrass, and mountain hemlock/beargrass are on ridges. Their productivity for timber is lower than that of the major habitat type.

Geology

This map unit is underlain by argillite, siltite, and quartzite of the Belt supergroup. These rocks produce medium textured and moderately coarse textured material when weathered.

Characteristics of the Soils

The soils in this map unit have a surface layer of loess that has been influenced by volcanic ash. The surface layer is 7 to 18 inches thick. It is medium textured. The content of angular rock fragments in the subsoil ranges from 50 to 70 percent.

Map Unit Composition

The dominant soils are loamy-skeletal, mixed Andic Cryochrepts. They have a surface layer of loess 7 to 14 inches thick. The similar soils have a surface layer of loess 14 to 18 inches thick. They are medial over loamy-skeletal, mixed Entic Cryandepts. The dominant and similar soils make up about 60 percent of the unit.

The Rock outcrop is on the upper slopes and ridges. It makes up about 20 percent of the unit.

The components of this unit occur in areas so intricately mixed that it was not practical to map them separately at the scale used.

Dissimilar soils make up about 20 percent of the unit. They are Andic Cryumbrepts and Lithic Cryochrepts. The Andic Cryumbrepts are in basins. They have a dark surface layer and a water table that fluctuates. The Lithic Cryochrepts are on the upper slopes and ridges. They are 4 to 20 inches deep over bedrock. Their productivity for timber is lower than that of the dominant soils.

Representative Profile of the Soils

The dominant soils have a surface layer of dark brown silt loam about 8 inches thick. The upper part of the subsoil is yellowish brown very stony silt loam about 8 inches thick. The lower part is light olive brown very stony silt loam about 25 inches thick. The substratum to a depth of 60 inches or more is dark grayish brown very stony sandy loam.

Management

Timber

The potential annual production is high in forested areas. Productivity in the map unit is limited by the Rock outcrop. The slope limits the operation of tractors in some areas. A combination of tractor and cable logging systems helps to overcome the slope. Productivity on the site is highly dependent on the loess surface layer. If tractors are operated on the site, productivity can be lowered because the loess surface layer can become compacted or be displaced or it can be mixed with subsoil material. Regeneration of the forest is limited by plant competition. Menziesia competes vigorously with tree seedlings in open areas.

Roads

The hard rock frequently limits excavation during road construction. Unsurfaced roads are rough because of large stones or cobbles.

Watershed

Erosion is a moderate hazard along skid trails and fire lines. The material exposed by road construction has a slight hazard of erosion. Sediment delivery efficiency is moderate.

Wildlife and fisheries

This map unit can provide habitat for mule deer and elk in summer. It also provides food sources for grizzly bears.

Recreation and visual quality

Hunting, hiking, picking berries, and viewing scenery are common recreational activities in areas of this map unit. Maintaining the visual quality of the unit is difficult because roadcuts on steep slopes are visually prominent.

570—Andic Dystrochrepts-Typic Ustochrepts complex, mountain slopes

This map unit is on mountain slopes. Elevation ranges from 2,500 to 5,000 feet. The vegetation consists of moist, mixed forest and dry, mixed forest. The soils formed in material weathered from granitic rocks.

Landform

The dominant slopes have gradients of 35 to 60 percent. Slopes that have southerly aspects are generally steeper than those that have northerly aspects. The mountain slopes are slightly convex on the upper half and linear on the lower half. The drainage pattern is dendritic, and drainage channels are deeply incised.

Vegetation

On northerly aspects the vegetation is a mixed forest of western hemlock, Douglas-fir, western larch, grand fir, lodgepole pine, and ponderosa pine. On southerly aspects it is a mixed forest of Douglas-fir and ponderosa pine. The forest understory is dominated by shrubs and forbs.

Habitat Types

Habitat types vary with the aspect. Western hemlock/queencup beadlily and western redcedar/queencup beadlily are the major habitat types on northerly aspects. Grand fir/queencup beadlily is a similar habitat type. These habitat types are in about 60 percent of the unit. Douglas-fir/ninebark is the major habitat type on southerly aspects. Douglas-fir/snowberry is a similar habitat type. These habitat types are in about 40 percent of the unit.

Geology

These soils are underlain by granitic rocks. These rocks produce coarse textured material when weathered.

Characteristics of the Soils

These soils have a medium textured surface layer. The content of angular rock fragments in the subsoil ranges from 50 to 70 percent. The soil properties vary with aspect. The surface layer of the soils on northerly aspects has been influenced by volcanic ash. The surface layer of the soils on southerly aspects has not been influenced by volcanic ash.

Map Unit Composition

The dominant soils are loamy-skeletal, mixed, frigid Andic Dystrochrepts and loamy-skeletal, mixed, frigid Typic Ustochrepts. The Andic Dystrochrepts are on northerly aspects. They make up about 60 percent of the unit. The Typic Ustochrepts are on southerly aspects. They make up about 40 percent of the unit.

The components of this unit occur in areas so intricately mixed that it was not practical to map them separately at the scale used.

Representative Profile of the Soils

The Andic Dystrochrepts are yellowish brown gravelly silt loam in the upper 7 inches of the surface layer. The lower 13 inches of the surface layer is very pale brown very gravelly very fine sandy loam. The subsoil is strong brown very gravelly very fine sandy loam about 21 inches thick. The substratum to a depth of 60 inches or more is pale brown very gravelly loamy sand.

The Typic Ustochrepts have a surface layer of dark gray very gravelly very fine sandy loam about 8 inches thick. The subsoil is gray very gravelly sandy loam about 19 inches thick. The substratum is gray very gravelly very fine sandy loam. Bedrock is at a depth of about 45 inches.

Management

Timber

The potential annual production is high on northerly aspects and moderate on southerly aspects. Solar insolation limits productivity on southerly aspects. The slope limits the operation of tractors. Regeneration of the forest is limited by the solar insolation on southerly aspects. Rotting wood is an important nitrogen source on southerly aspects. Leaving large diameter slash on the site after logging helps to maintain fertility.

Roads

Material exposed in cutbanks during road construction tends to ravel if the cutbanks are steep. It is difficult to revegetate because of moisture stress on southerly aspects. The coarse textured substratum has a low water-holding capacity. Tread erosion tends to remove fine textured material from unsurfaced roads. The remaining gravel and cobbles form a rough surface. Unsurfaced roads have a loose, gravelly or cobbly sandy surface when the soils are dry.

Watershed

Erosion is a moderate hazard along skid trails and fire lines. The material exposed by road construction has a severe hazard of erosion. Sediment delivery efficiency is moderate.

Wildlife and fisheries

This map unit can provide habitat for elk, deer, and bear on southerly aspects in spring and on northerly aspects in summer. It provides food sources for grizzly bears.

Recreation and visual quality

Hunting, picking berries, and gathering wood are common recreational activities in areas of this map unit. Maintaining the visual quality of the unit is difficult on southerly aspects because revegetating roadcuts is difficult.

Use and Management of the Soils

Following is a description of the use and management of the soils in the survey area. The properties that influence the productivity and suitability of the land for a variety of resource uses are described. The criteria utilized in developing interpretations for the detailed soil map units in the survey area also are described.

Timber

Mark Romey, silviculturist, helped prepare this section.

Approximately 99 percent of the survey area is forested. Douglas-fir, western larch, lodgepole pine, western white pine, Engelmann spruce, ponderosa pine, grand fir, western hemlock, and western redcedar are the principal commercial species. Currently, about 125 million board feet of timber is harvested annually from the survey area. The surface layer of soils, especially in areas where ash is present, is very permeable and has low bulk density. Using a tractor to log, pile slash, and prepare the site can result in the surface layer being mixed with other soil material or becoming compacted or displaced. As a result, productivity is reduced and erosion is a hazard *(2)*. The operation of tractors should be carefully planned to minimize the extent of the area affected.

Timber Management and Productivity

Table 5 can be used by forest managers in planning the use of soils for production of wood products. Only the map units that have a forested component are listed in the table.

Tractor operation gives limitations that are incurred when rubber-tired or tracked vehicles are used to skid logs, pile brush, or perform similar forest management practices. The limitations are soil damage, slope, complex slope, and rock outcrop.

Soil damage is a management concern on soils vegetated with moist, mixed forest or subalpine forest where the slope is not so steep that it limits the operation of tractors. Soils supporting this vegetation are seldom dry enough that tractors can be operated on them without the surface layer becoming compacted. Most of the soils have a surface layer that has been influenced by volcanic ash and have a bulk density of less than 0.95 gram per cubic centimeter. Operating tractors only when the soils are covered with snow, limiting the extent of the area on which the tractors are operated, and limiting the use of tractors to ground skidding only minimize soil damage.

The slope is a limitation in map units that have a dominant slope of 35 percent or more. Operating tractors on these slopes can be unsafe and cause the surface layer to be displaced or excessively mixed with other soil material. A cable logging system helps to overcome the slope.

Complex slope is a management concern in map units where the operation of tractors is both limited in areas where the slope is more than 35 percent and not limited in areas where the slope is less than 35 percent. A combination of tractor and cable logging systems helps to overcome this limitation.

Rock outcrop is a limitation in map units having both a rock outcrop component and slopes that are suited to the operation of tractors. The rock outcrop on ledges limits the operation of tractors. A cable logging system helps to overcome this limitation.

Regeneration gives limitations to forest regeneration in cutover or burned areas. The limitations in the survey area are frost pockets, insolation, competition, and harsh climate.

Frost pockets are low areas where cold air drainage accumulates at night. Frequent frosts during the growing season limit species adaptation and regeneration. This limitation is associated with stream bottoms, kames and kettles, and moraines in narrow U-shaped glacial valleys.

Insolation, or exposure to sunlight, limits regeneration on steep, southerly aspects. Surface soil temperatures in unshaded areas in summer can be lethal to seedlings. Insolation is a limitation on south-facing slopes of more than 35 percent.

Competition is a limitation when aggressive understory species invade openings in the forest canopy. It is a limitation in map units that have

pinegrass, menziesia, or beargrass in the forest understory.

Harsh climate is a limitation resulting from the short growing season, persistent snowbanks, and exposure to wind in open areas. It is a limitation in map units that are vegetated with subalpine forest.

Sediment hazard gives the rating assigned to each map unit for the sediment hazard along skid trails and fire lines and in other areas where the soils have been disturbed during logging and site preparation. The hazard is relative to the other map units in the survey area. The rating can be used to evaluate the need for erosion- and sediment-control practices and to compare the hazard in alternative areas. The hazard of erosion for the surface layer and the rating of sediment delivery efficiency are used to determine the sediment hazard. The susceptibility of the soils to erosion and the sediment delivery efficiency are given in table 8. In table 5, map units rated *slight* have a slight hazard of erosion in the surface layer. Map units rated *moderate* have a moderate or severe hazard of erosion in the surface layer and low or moderate sediment delivery efficiency. Map units rated *severe* have a severe hazard of erosion in the surface layer and moderate or high sediment delivery efficiency or a moderate or severe hazard of erosion in the surface layer and high sediment delivery efficiency.

Nonforested area gives the percentage of each map unit that generally is rock outcrop or is vegetated by shrub or meadow plant communities. The productivity for timber is reduced in proportion to the nonforest components.

Forest vegetative group gives the habitat type group. These groups have a relatively narrow range of timber productivity and similar limitations that affect forest regeneration. They are described under the heading "General Nature of the Survey Area."

Relative productivity gives the rating of relative timber productivity for the forested components of the map units. The relative productivity is based on stand conditions and soil properties. Site index data is not available for specific soils or map units; however, it has been collected for stands and provides a basis for estimating quantitative potential yield for soils. The potential productivity is estimated for each relative potential productivity class. The estimates are for the maximum mean annual increment attainable in a fully stocked, natural stand. The quantitative estimates provide the user with a general impression of potential timber productivity in the survey area. They should not be used if quantitative reliability is important.

Map units rated *high* have moist, mixed forest vegetation. In most of the units rated high, the surface layer is loess that has been influenced by volcanic ash. The estimated potential yield is 85 to 140 cubic feet per acre per year.

Map units rated *moderate* have dry, mixed forest vegetation. They tend to be on southerly aspects or at low elevations in the eastern part of the survey area. In most of the units rated moderate, the surface layer is loess that is mixed with underlying material. The loess has been influenced by volcanic ash. The soils are 20 to more than 60 inches deep. The estimated potential yield is 50 to 85 cubic feet per acre per year.

Map units rated *low* have subalpine forest vegetation or dry, mixed forest vegetation. The soils vegetated with subalpine forest are 20 to more than 60 inches deep, and those vegetated with dry, mixed forest are less than 20 inches deep. These units are on mountain ridges and slopes. The estimated potential yield is 20 to 50 cubic feet per acre per year.

Map units rated *very low* have open-grown forest vegetation or subalpine forest vegetation. The soils are less than 20 inches deep. The units generally are on glaciated mountain ridges or south-facing mountain slopes. The estimated potential yield is less than 20 cubic feet per acre per year.

Roads

Mike Remboldt, engineering geologist, helped prepare this section.

Road construction is the main engineering use of soils in forest management. About 3 or 4 miles of road is required to manage 1 square mile of timber. Several kinds of roads are constructed to be used in forest management. Arterial and collector roads generally are 12 feet wide and have a ditch, or they are 14 feet wide and have a rolling grade or have been outsloped to provide for drainage. Local logging roads generally are drained by rolling grades and water bars and occasionally by outsloping. They often are closed when logs are not being hauled. They generally are not surfaced.

Data in this section can be used when choosing among alternative road locations and designs. Land use planners can use it to evaluate the feasibility of allocating land to uses requiring roads. Transportation planners can use it to evaluate alternative routes. Design engineers can use it to plan detailed onsite investigations of soil and geology. This information does not eliminate the need for onsite investigation and testing.

Engineering Properties and Classification

Table 6 gives estimates of the engineering properties and classification for material in road cutbanks and roadfill. For most of the map units in the survey area, the material rated is from the lowest part of the profile,

which is at a depth of about 40 to 60 inches. The upper part of the subsoil, which is at a depth of about 20 to 40 inches, is rated when the dominant slopes in the map unit are less than 15 percent. Road construction in these areas requires only minor excavation. The estimates can be used in planning detailed onsite investigations. Estimates are based on field examination and laboratory tests of samples from the survey area.

USDA texture for road cutbanks is the dominant texture for the greater portion of the cutbank area in the map unit. Soil texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. If the content of particles coarser than sand is as much as about 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the "Glossary."

The *Unified classification* of the soils is determined according to the Unified soil classification system *(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 and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC and silty and clayey soils as ML, CL, OL, MH, CH, and OH. Soils exhibiting engineering properties of two groups can have a dual classification, for example, GW-GM.

Fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area and on field examination.

Road Construction and Maintenance

Table 7 shows the limitations affecting road construction and maintenance in each of the detailed soil map units. This information can be used to compare construction and maintenance limitations on alternative road locations and to plan detailed onsite investigations.

Excavation for roads in the survey area is limited by slope, wetness, and hard rock.

The slope is a limitation because it increases the amount of material that is excavated during construction. If a map unit has dominant slopes of 50 percent or more, slope is a limitation.

The wetness is a limitation in map units where the soils have a water table that fluctuates. During excavation in these units, the ground water is intercepted. In some areas soils having a water table that fluctuates are mapped with others having a water table that does not fluctuate. In these areas the extent of the wetness must be determined by onsite investigation.

The hard rock is a limitation in areas where it is encountered during excavation because it increases the difficulty of excavation. It is a limitation in map units where rock outcrop is a named component and in map units where the dominant soils have bedrock within 20 inches of the surface.

Maintenance of cut and fill areas gives limitations to maintenance of road cutbanks and roadfill. The limitations are cutbank slough, cutbank ravel, landslides, and avalanches. The maintenance of cutbanks is limited by slough and ravel, and the maintenance of roadfill is limited by landslides and avalanches.

Cutbank slough is associated with a seasonal high water table or a perched seasonal high water table and a slowly permeable substratum. It is a limitation in map units having slope of more than 15 percent if the soil in the lower part of the profile formed in compact glacial till, if the landform contains seeps or springs, or if the soils have a water table that fluctuates.

Cutbank ravel is associated with friable, moderately coarse textured or coarse textured material containing rounded rock fragments. It is a limitation in map units having slope of more than 15 percent if the soil in the lower part of the profile formed in friable glacial till or in weathered granitic or micaceous rocks.

Landslides and avalanches can damage roadfill and deposit debris on road surfaces. Landslides in drainageways occur on dissected glaciated mountain slopes. Avalanches occur in areas of glacial trough walls and glacial cirque headwalls.

Fill material used for surfacing roads gives the limitations of the soil material if it is used as fill for road surfaces. Tread erosion, large stones, rut formation, rock fall, and soil that is too sandy are the limitations. Surfacing the roads with suitable material helps to overcome all of the limitations except for rock fall.

Tread erosion is the removal of fine textured material from unsurfaced roads by sheet and rill erosion. The remaining gravel and cobbles form a rough surface. If

fill is taken from a map unit where the soil material below the surface layer has a moderate or severe hazard of erosion (see table 8), tread erosion is a limitation.

Large stones cause rough road surfaces, which are difficult to blade. If fill is taken from a map unit in which excavation is limited by hard rock or in which the soil in the lower part of the profile is very stony sandy loam that formed in friable glacial till, large stones are a limitation. When hard rock is excavated, large fragments of rock are mixed with the fill material.

If fill is taken from a map unit in which the content of rock fragments in the lower part of the profile is less than 35 percent, the formation of ruts is a management concern.

If fill is taken from a map unit having dominant slopes of 60 to 80 percent and the road cutbanks are fractured bedrock or friable glacial till, rock fall is a hazard. The road cutbanks are very steep, and loose rock from the cutbanks can roll onto the road surface causing a driving hazard.

If fill material is taken from a map unit having a slope of more than 15 percent and the soil in the lower part of the profile is coarse textured, a limitation of too sandy is assigned. The surface of the roads is loose and sandy when the soils are dry.

Revegetation shows limitations to establishing vegetation on roadcuts and in areas of roadfill. The limitations in the survey area are soil crusting, moisture stress, and harsh climate.

Soil crusting is a limitation affecting revegetation if the soil in the lower part of the profile formed in dense glacial till or lacustrine sediments. Generally, 50 to 70 percent of the soil particles less than 2 millimeters in diameter are silt or very fine sand in these materials. If the soil material has a high content of silt or very fine sand, a crust can form. This crust hinders the establishment of seedlings. Reseeding as soon as possible after construction minimizes soil crusting.

Moisture stress is a limitation affecting revegetation if hard rock is encountered during excavation, if the soil in the lower part of the profile is coarse textured and the slope is steep, or if the soil is vegetated with mountain grassland, open-grown forest, or dry, mixed forest. In map units where hard rock is encountered during excavation, the roadcuts tend to be fractured rock or fractured rock mixed with soil. The content of rock fragments in these map units limits the water-holding capacity. The areas of fractured rock cannot support vegetation. In map units where the soil in the lower part of the profile is coarse textured and the slope is steep, the roadcuts and roadfill are mainly coarse textured material that has a low water-holding capacity. Map units that are vegetated with mountain grassland, open-grown forest, or dry, mixed forest receive limited rainfall in the summer or are on southerly aspects, which have a high rate of evapotranspiration. Mulching and planting species that can withstand the drought in the summer help to overcome moisture stress.

The harsh climate is a limitation affecting revegetation of map units on mountain ridges at the higher elevations. The short growing season and exposure to drying winds hinder the establishment of seedlings. Planting climatically adapted species helps to overcome this limitation.

Sediment hazard on roads gives the rating assigned to each map unit for the sediment hazard on roads. The hazard is relative to the other map units in the survey area. The rating can be used to evaluate the need for erosion- and sediment-control practices and to compare the hazard in alternative areas. The hazard of erosion and the rating of sediment delivery efficiency are used to determine the sediment hazard on roads. The hazard of erosion for the soil in the lower part of the profile and the sediment delivery efficiency are given in table 8. The hazard of erosion for the soil in the upper part of the subsoil is used in map units having dominant slopes of less than 15 percent. The hazard of erosion for the soil in the upper part of the subsoil does not appear in table 8 but was determined using the same criteria as used for the erosion hazard of the rest of the profile.

Map units rated *slight* have a slight hazard of erosion on roads and a low or moderate sediment delivery efficiency. Map units rated *moderate* have a moderate hazard of erosion on roads and a low or moderate sediment delivery efficiency or a slight hazard of erosion and a high sediment delivery efficiency. Map units rated *severe* have a moderate hazard of erosion on roads and a high sediment delivery efficiency or a severe hazard of erosion on roads and a low, moderate, or high sediment delivery efficiency.

Watershed

Larry Meshew, hydrologist, helped prepare this section.

Annually, about 4.1 million acre-feet of water drains into the Columbia River from the survey area. Three major reservoirs within the survey area are used to generate power and control floods. The area includes about 150 lakes and 3,200 miles of perennial streams. Most of the lakes and streams provide habitat for fish and are used for recreational activities. Some are a source of domestic water supplies.

Forestry management practices, including logging, burning, road construction, and site preparation, can expose soils to erosion. The erosion can be a source of sediment in streams, lakes, and reservoirs. The sediment can damage the fish habitat, reduce the

capacity of the reservoirs, and increase the cost of treating domestic water supplies. Soil and water conservation practices help to control erosion and minimize the amount of sediment in streams, lakes, and reservoirs.

Soil Erosion and Sedimentation

Table 8 gives the hazard of erosion for the surface layer and the soil in the lower part of the profile and the rating for sediment delivery efficiency. It can be used to determine if onsite evaluation is needed. Watershed scientists use models, which require information from this table, to predict sediment yield.

Susceptibility of the soil to erosion gives the relative susceptibility of exposed soil to erosion. The ratings are based on observations of erosion in the survey area and on the properties of the soil. The *surface layer* gives the rating if practices that remove the vegetative cover and expose the surface layer to the hazard of erosion are applied. Logging skid trails, fire lines, and severely burned areas are examples. The *lower layer* gives the rating if practices that require excavation exposing the soil in the lower part of the profile to the hazard of erosion are applied. Roadcuts and fill slopes are examples.

A rating of *slight* is assigned to soil layers having a loamy texture and a content of angular rock fragments ranging from 35 to 85 percent or a content of rounded rock fragments ranging from 60 to 85 percent. Soil layers formed in material weathered from metasedimentary rocks have a slight hazard of erosion.

A rating of *moderate* is assigned to soil layers having a loamy texture and a content of rounded rock fragments ranging from 15 to 60 percent or a content of angular rock fragments ranging from 15 to 35 percent. Soil layers formed in loess that has been influenced by volcanic ash or in glacial till have a moderate hazard of erosion.

A rating of *severe* is assigned to soil layers having a sandy texture or a loamy or clayey texture and a content of rock fragments of less than 15 percent. Soil layers formed in lacustrine deposits, sandy glacial outwash, or material weathered from granitic rocks have a severe hazard of erosion.

In areas where the hazard of erosion is moderate or severe, an onsite evaluation should be made to determine if erosion- and sediment-control practices are necessary. Controlling erosion is more difficult in areas that have a severe hazard of erosion than in those that have a moderate hazard of erosion.

Sediment delivery efficiency is a rating of the relative probability of eroded soil reaching a stream channel and becoming sediment. It is used in evaluating the hazard of sedimentation. The transport of eroded soil across the landscape is a complex process affected by many properties that must be evaluated onsite. The properties of the landforms that affect sediment delivery were considered when this rating was assigned. They include the type of landform, the slope, and the distance between drainageways.

Map units rated *low* are on mountain ridges, moraines, drumlins, or high terraces. They have almost no surface drainage channels or have a deranged drainage pattern. Slopes generally are less than 35 percent. Most of the eroded soil is deposited before it reaches a drainage channel. Less than 10 percent of the landforms are close enough to the drainage channels for eroded soil to become sediment.

Map units rated *moderate* are on mountain slopes. They have a dendritic drainage pattern. The drainageways are widely spaced. Slopes generally range from 15 to 60 percent. About 10 to 40 percent of the landforms are close enough to the drainage channels for eroded soil to become sediment.

Map units rated *high* are on breaklands, dissected glaciated mountain slopes, glacial trough walls, glacial cirque headwalls, stream flood plains, low terraces, or moraines in the bottom of U-shaped glacial valleys. The breaklands, trough walls, and cirque headwalls have slopes of 60 to 80 percent, and eroded soil can travel a relatively long distance to the drainage channel. The dissected glaciated mountain slopes have closely spaced, low order drainage channels, and most of the erosion occurs in areas close enough to the drainage channel to be a sediment hazard. The flood plains, low terraces, and glacial valley moraines parallel large streams. Most of the soil erosion is close enough to a stream to be a sediment hazard. About 40 to 100 percent of these landforms are close enough to the drainage channel for eroded soil to become sediment.

Wildlife and Fisheries

Alan Christensen, wildlife biologist, helped prepare this section.

This survey area provides diverse wildlife habitat for many game and nongame wildlife species. Big game species include elk, moose, black bear, grizzly bear, whitetail deer, mule deer, bighorn sheep, and mountain goat. Hunting big game is a popular recreational activity in the survey area. The survey area has large herds of elk, and elk hunting is particularly popular.

Wildlife habitat management in the survey area normally consists of two general kinds of activities. Existing wildlife habitat values are identified and are protected or enhanced by coordinating activities, such as timber harvest, road construction, and recreational

uses, with use of habitat by wildlife. The habitat also is directly improved by applying practices to improve the quality of vegetation for wildlife use. An example is prescribed burning.

A wide variety of fish species is in the survey area. The species include cutthroat, rainbow, brook, brown, bull, and lake trout; largemouth and smallmouth bass; burbot; mountain whitefish; northern pike; pumpkinseed sunfish; yellow perch; bullhead catfish; and kokanee salmon.

The Kootenai River and its tributaries are replenished naturally with fish, while most high mountain lakes are stocked. Human activities can greatly impact the natural reproduction of native fish. Sedimentation is a management concern in the survey area.

Soil properties, slope, elevation, aspect, and other properties of the map units in this survey area directly affect the kind and amount of vegetation available to wildlife and the accessibility of the vegetation. This survey can be used to help identify and inventory potential wildlife habitat. When inventorying wildlife habitat, the detailed soil map units can be used as sampling units, thereby holding relatively constant those properties affecting the kind and amount of vegetation and the accessibility of the vegetation to wildlife. When planning, the properties of the map units can be used to evaluate potential habitat values of alternative areas and the potential for habitat improvement. The map unit descriptions describe some potential habitat values for wildlife and fish; however, the importance of map unit properties in evaluating potential habitat value varies with different species and with the location of delineation boundaries. Wildlife and fisheries biologists should be consulted when using this survey to evaluate potential habitat values of specific map units.

Recreation and Visual Quality

Recreational activities in the survey area include hunting, fishing, gathering firewood, picking berries, hiking, boating, cross-country skiing, and photographing nature. Soil properties, slope, aspect, elevation, vegetation, and other properties of the detailed soil map units affect suitability for recreational use. The common recreational activities and limitations to maintaining the visual quality of the unit are described in the detailed soil map units. This survey can be used during the planning process to identify areas suitable for a recreational use and limitations to maintaining the visual quality. Specialists in recreational use and visual management should be consulted to determine which map unit properties affect the recreational use or visual quality objectives. The detailed soil map units can then be used to help identify suitable areas.

Wildfire

Plans for wildfire control are incorporated into land management plans and fire management plans. This soil survey can be used to estimate suppression costs and predict the effect of fire on vegetation and soils.

The detailed soil map units identify the habitat types and describe the extent of their distribution within the map units. The habitat types can be used to help predict the response of vegetation to fire.

Suppression costs are partially dependent on terrain and soil properties, which are described in the map unit descriptions. Slope, rock outcrop, and the content of rock fragments in the surface layer are some of the properties that affect the cost of constructing a fire line. The susceptibility of the surface layer to erosion is given in table 8. This information can be used to plan the erosion-control measures to be applied to soil that has been disturbed by fire suppression activities.

Minerals

This soil survey can be used to help evaluate the effect of mineral exploration activities on soils and vegetation and to determine the conservation practices that should be applied in areas being rehabilitated after exploration. The soils, vegetation, landform, and geology are described in the detailed soil map unit descriptions. Table 7 gives limitations to excavation and revegetation of roadcuts and fill slopes. These limitations also apply to many kinds of mineral exploration activities. The map unit descriptions and table 7 can be used to determine which erosion- and sediment-control practices should be applied following mineral exploration activities.

Range

Livestock grazing is an important use of mountain grasslands in the Tobacco River valley. The rest of the survey area is densely forested, and livestock grazing is limited in these areas to transitory ranges created by timber harvest or forest fires. Generally, the livestock is cattle.

This soil survey can be used to estimate potential forage production and identify limitations to livestock grazing. The detailed soil map units identify the habitat types and describe the extent of their distribution in the map units. The habitat types can be used to estimate the potential forage production. The map units also describe slope, the seasonal high water table, and other properties that can limit livestock access to forage. Range conservationists should be consulted when using

this soil survey to plan livestock grazing. Private landowners can obtain assistance from their local Soil Conservation District.

Wilderness

The Cabinet Mountains Wilderness is in the survey area, along the crest of the Cabinet Mountains. It is about 94,000 acres in size.

Wilderness is managed to preserve its natural character. The objective of many wilderness management practices is to minimize the effect of authorized uses on the wilderness. Recreational uses are the most common authorized uses. This survey can be used to plan some wilderness management practices. The maintenance and construction of trails, the rehabilitation of heavily used camp areas, and a planned grazing system for horses and pack animals are examples of wilderness management practices affected by properties of the soils, landform, and vegetation described in the detailed soil map units. The map units are not site specific and do not eliminate the need for detailed onsite investigation.

The map units also are basic ecological subdivisions of the wilderness landscape. They can be used as basic sampling units when inventorying and describing wilderness ecosystems.

Specialists in wilderness management should be consulted when using this survey to plan wilderness management.

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories *(5)*. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Tables 9 and 10 show the classification of the soils in the survey area. The taxonomic categories are defined in the following paragraphs.

ORDER. Eleven soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol.* An example is Inceptisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Ochrept (*Ochr*, meaning pale, 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 development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Cryochrepts (*Cry*, meaning cold, plus *ochrept*, the suborder of the Inceptisols that has an ochric epipedon).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic subgroup is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other taxonomic class. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Andic* identifies the subgroup that intergrades toward the Andisol order. An example is Andic Cryochrepts.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties that affect management. Generally, the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle size, mineral content, soil temperature regime, soil depth, and reaction. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is loamy-skeletal, mixed Andic Cryochrepts.

SERIES. The series consists of soils within a family that have horizons similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. In this survey area, soils were mapped at a higher taxonomic level and series were not recognized.

The soils in the survey area are in both cryic and frigid temperature regimes. The lower elevation boundary of subalpine fir climax forest was used as a vegetative indicator of the boundary between them. Soil temperature data collected for the soil survey of the Flathead National Forest area, which is adjacent to the Kootenai National Forest area, and soil temperature data from much of the Northern Rocky Mountains area indicate this is a close approximation.

The soils in the survey area are also in xeric, ustic, and udic moisture regimes. Vegetative indicators were used to place soils in moisture regimes. Open-grown forests containing ponderosa pine with bunchgrass understories and mountain grasslands are considered indicators of the xeric moisture regime. Dense Douglas-fir climax forests with shrub-dominated understories are considered indicators of the ustic moisture regime. Dense forests in which western larch is a potential major stand component with blue huckleberry, twinflower, or ninebark in the understory are considered indicators of the udic moisture regime. A limited amount of soil moisture data indicates these are reasonable indicators of soil moisture regimes in the survey area. These regimes also are used in adjacent survey areas.

The soils in the survey area are both less than and more than 60 percent base saturated. Base saturation

cannot be estimated accurately with field techniques. A limited amount of laboratory data indicates soils in the udic moisture regime that formed in parent material derived from quartzite or granitic rock or in glacial drift dominantly derived from this rock are dominantly less than 60 percent base saturated. Other soils are dominantly more than 60 percent base saturated. In many of the map units, the soils are both more than and less than 60 percent base saturated. The dominant base saturation is assumed based on the parent material and the moisture regime.

Mixed, illitic and micaceous mineralogy classes have been identified in the survey area. Illitic and micaceous classes are each used to classify soils in one map unit. In each case the class used is supported by laboratory data and strongly associated with a unique parent material.

A representative pedon for each of the soils mapped in the survey area follows. The descriptions are arranged in alphabetical order by suborder. The representative pedons are preceded by a brief discussion of taxa at higher levels than the representative pedon. The range of characteristics of soils in the taxa follows the representative pedon. Soil colors are for moist soil unless otherwise indicated.

Andepts

The Andepts in the survey area have a thick surface layer of loess that has been influenced by volcanic ash. The surface layer is more than 14 inches thick and has bulk density ranging from 0.65 to 0.85 gram per cubic centimeter. Laboratory data indicate the loess contains 60 to 70 percent glass shards in the fine sand and silt particle-size fractions. This loess has some properties suggestive of thixotropy. X-ray refraction data indicate large amounts of amorphous material in the clay particle-size fraction.

Vitrandepts

Vitrandepts are relatively warm Andepts in which the soil material is dominated by volcanic glass.

Umbric Vitrandepts

Umbric Vitrandepts are Vitrandepts that have a dark surface layer. In this survey area these soils are wet during much of the spring and early summer. The ground water is well aerated. The subsoil has chroma of 3 or more. It is commonly mottled with colors having chroma of 3 or more. Umbric Vitrandepts are in depressions. The depressions receive runoff and sediment from adjacent slopes mantled with loess. The parent material of these soils is loess over lacustrine sediment or glacial till. The loess has been influenced by volcanic ash. The vegetation is black cottonwood, paper birch, and quaking aspen with Engelmann spruce around the edge of the depressions.

Umbric Vitrandepts, Medial Over Loamy, Mixed, Frigid

Representative Pedon

O—2 inches to 0; pine needles and twigs.

Bs1—0 to 2 inches; very dark brown (10YR 2/2) silt loam; weak very fine granular structure; many very fine and fine and common medium roots; moderately acid; gradual wavy boundary.

Bs2—2 to 10 inches; very dark grayish brown (10YR 3/3) silt loam; weak fine granular structure; soft, very friable, slightly sticky and nonplastic; many very fine and fine and common medium roots; slightly acid; gradual wavy boundary.

Bs3—10 to 21 inches; yellowish brown (10YR 5/6) silt loam; few fine distinct dark yellowish brown (10YR 4/4) mottles; weak or moderate fine subangular blocky structure; soft, very friable, slightly sticky and nonplastic; many very fine, few medium, and common coarse roots; slightly acid; abrupt irregular boundary.

2C1—21 to 44 inches; light gray (5Y 7/2) silt; massive; very hard, firm or very firm, sticky and slightly plastic; small pockets of clay; common very fine and fine, few medium, and few coarse roots; moderately acid; gradual wavy boundary.

2C2—44 to 62 inches; pale olive (5Y 6/3) silt; massive; hard, firm, sticky and slightly plastic; moderately acid.

Location and Setting

Northwestern Montana, Lincoln County, Cabinet Range, Blue Creek, SW½ sec. 18, T. 32 N., R. 30 W., detailed soil map unit 104. The profile described is in a concave depression, or glacial kettle. The parent material is loess over silty lacustrine sediments. The loess has been influenced by volcanic ash and deposited by runoff from surrounding moraines. Elevation is about 3,000 feet. The vegetation is moist, mixed coniferous forest.

Range in Characteristics

The Bs1 and Bs2 horizons have hue of 7.5YR or 10YR, value of 2 to 4, and chroma of 1 to 3. Texture is silt loam. Reaction is slightly acid or moderately acid. The combined thickness of the horizons is 7 to 14 inches.

The Bs3 horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 3 to 6. It generally has dark yellowish brown mottles. Texture is loam or silt loam.

Reaction is slightly acid or moderately acid. The horizon is 8 to 20 inches thick. Ground water is perched in this horizon because the underlying horizon has a slower rate of permeability.

The 2C horizon has hue of 5Y, 2.5Y, or 10YR, value of 4 to 7, and chroma of 1 to 6. Texture is silt, silt loam, or gravelly very fine sandy loam. Reaction is moderately acid or slightly acid. Bulk density is 1.5 to 1.8 if the soils formed in compact glacial till and 1.2 to 1.4 if they formed in silty lacustrine material.

Aquolls

Aquolls are wet soils that have a dark surface layer. They are of minor extent in this survey area.

Calciaquolls

Calciaquolls are Aquolls that have an accumulation of lime within 16 inches of the surface.

Aeric Calciaquolls

Aeric Calciaquolls are on alluvial fans and narrow flood plains along small mountain streams. Their water table rises to within 12 to 30 inches from the surface in spring when the snow melts. The ground water contains calcium bicarbonate, and evaporation causes large amounts of lime to precipitate in the surface layer. The ground water is well aerated, and the soil is not mottled or gleyed. The parent material is 30 inches or more of silty alluvium over calcareous glacial till. The alluvium contains loess that has been influenced by volcanic ash and soft, powdery lime. The vegetation is moist, mixed forest. The habitat types are in the subalpine fir and Engelmann spruce series. These soils generally are in low frost pockets. The habitat types on the surrounding uplands are in the Douglas-fir series.

Aeric Calciaquolls, Fine-Silty, Frigid

Representative Pedon

Ak—0 to 8 inches; very dark brown (10YR 2/2) silty clay loam; weak fine granular structure; soft, friable, slightly sticky and slightly plastic; many very fine, fine, and medium roots; lime disseminated throughout, violently effervescent, slightly alkaline; clear wavy boundary.

Bk1—8 to 20 inches; dark brown (10YR 4/3) silty clay loam; weak fine subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; common medium and few coarse roots; lime disseminated throughout, violently effervescent, slightly alkaline; clear wavy boundary.

Bk2—20 to 25 inches; dark grayish brown (10YR 4/2) silt loam; weak medium subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; common medium and few coarse roots; lime disseminated throughout, violently effervescent, moderately alkaline; gradual wavy boundary.

Akb—25 to 28 inches; black (10YR 2/1) silt loam; weak medium angular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; common very fine, fine, and medium roots; lime disseminated throughout, violently effervescent, slightly alkaline; abrupt wavy boundary.

Bkb—28 to 34 inches; dark yellowish brown (10YR 3/4) silt loam; moderate medium subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; few very fine and common fine and medium roots; lime disseminated throughout, violently effervescent, moderately alkaline; clear wavy boundary.

2Ab—34 to 36 inches; black (10YR 2/1) silt loam; weak fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine and few medium roots; about 5 percent pebbles; lime disseminated throughout, violently effervescent, moderately alkaline; clear wavy boundary.

2Bb—36 to 42 inches; dark grayish brown (10YR 4/2) very gravelly silt loam; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; about 40 percent pebbles; violently effervescent, moderately alkaline; abrupt wavy boundary.

2Cb—42 to 60 inches; yellowish brown (10YR 5/6) very gravelly silt loam; massive; slightly hard, firm, slightly sticky and slightly plastic; few fine and very fine roots; about 40 percent pebbles; violently effervescent, moderately alkaline.

Location and Setting

Northwestern Montana, Lincoln County, Salish Range, in the Lewis Creek drainage area, sec. 13, T. 33 N., R. 25 W., detailed soil map unit 325. The profile described is on a sloping alluvial fan. The parent material is alluvium over calcareous glacial till. The alluvium is mixed volcanic ash, finely divided lime, and silt. It is 40 percent or more finely divided lime. Elevation is 4,000 feet. The vegetation is moist, mixed forest. The habitat type is subalpine fir/twinflower.

Range in Characteristics

The Ak and Akb horizons have hue of 7.5YR or 10YR, value of 2 or 3, and chroma of 1 to 3. Texture is silt loam or silty clay loam. Reaction is slightly alkaline or moderately alkaline. These horizons are strongly effervescent or violently effervescent. The Ak horizon is

7 to 20 inches thick. The Akb horizon can be as little as 2 inches thick.

The Bk and Bkb horizons have hue of 7.5YR or 10YR, value of 4 to 8, and chroma of 2 to 6. Texture is silt loam or silty clay loam. These horizons are strongly effervescent or violently effervescent. The thickness of each of these horizons ranges from 4 to 20 inches.

The combined thickness of the Ak, Bk, Akb, and Bkb horizons is 30 to 60 inches or more.

The 2Ab, 2Bb, and 2Cb horizons formed in silt loam or silty clay loam glacial till. The content of pebbles in these horizons ranges from 5 to 50 percent. The horizons are slightly alkaline or moderately alkaline and are strongly effervescent or violently effervescent.

Boralfs

Boralfs are soils that have an accumulation of clay in the subsoil. The subsoil formed in lacustrine or glacial till material. Most areas of Boralfs are below elevations of 4,500 feet on gentle to moderately steep slopes. Average annual precipitation ranges from 15 to 35 inches.

Many of the Boralfs in the survey area have a surface layer of loess that has been influenced by volcanic ash. The surface layer is as much as 18 inches thick. Boralfs tend to be fertile. Their productivity for timber is relatively high.

Eutroboralfs

Eutroboralfs are the cool, base-saturated Boralfs. They have forest vegetation and are in the drier forested areas, near the boundary of forest and grassland. Both of the map units named for Eutroboralfs in this survey area have habitat types representative of the dry end of the range of coniferous forest.

Typic Eutroboralfs

Typic Eutroboralfs are freely drained Eutroboralfs having albic material that does not tongue into the argillic horizon. They represent the central concept, or typical member, of the Eutroboralfs great group. They share common taxonomic boundaries with Andic Dystric Eutrochrepts and Typic Eutrochrepts. The argillic horizon is weakly expressed in some soils, and the accumulation of clay can be near the lower limit defined for an argillic horizon. Some Typic Eutroboralfs have free carbonates in the subsoil.

Typic Eutroboralfs, Fine-Loamy, Mixed

Representative Pedon

O—3 inches to 0; duff and litter.

E—0 to 6 inches; light brownish gray (10YR 6/2) silt loam; few fine distinct grayish brown (2.5Y 5/2) mottles; moderate fine and medium granular structure; loose, friable, nonsticky and nonplastic; many very fine and fine and common medium roots; about 10 percent pebbles; strongly acid; abrupt smooth boundary.

Bt—6 to 20 inches; brownish yellow (10YR 6/6) silty clay loam; few fine distinct light olive brown (2.5Y 5/4) mottles; moderate fine and medium subangular blocky structure; firm, hard, sticky and plastic; common distinct clay films on faces of peds; common fine and medium and few very fine roots; about 5 percent pebbles; neutral; clear wavy boundary.

Bk1—20 to 31 inches; very pale brown (10YR 7/3) silty clay loam; few fine distinct pale olive (5Y 6/3) mottles; weak fine and medium angular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few fine and medium roots; about 10 percent pebbles; lime disseminated throughout and lime coatings on the underside of pebbles; violently effervescent, moderately alkaline; clear wavy boundary.

Bk2—31 to 60 inches; very pale brown (10YR 7/3) gravelly silty clay loam; few fine distinct olive (5Y 5/3) mottles; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; about 20 percent pebbles; lime disseminated throughout and lime coatings on the underside of pebbles; violently effervescent, moderately alkaline.

Location and Setting

Northwestern Montana, Lincoln County, Salish Range, Tepee Lake, sec. 35, T. 35 N., R. 27 W., detailed soil map unit 323. The profile described is on a south-facing slope on a moraine. Slope is 20 percent. The parent material is loess over silty glacial till. The loess has been influenced by volcanic ash. Elevation is 4,530 feet. The vegetation is dry, mixed coniferous forest. The habitat type is Douglas-fir/pinegrass.

Range in Characteristics

The E horizon has hue of 7.5YR, 10YR, or 2.5Y, value of 4 to 6, and chroma of 2 to 4. Texture is silt loam, gravelly silt loam, or silty clay loam. Reaction is neutral to strongly acid. The horizon is 4 to 12 inches thick.

The Bt horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 3 to 6. Texture is gravelly silty clay loam or silty clay loam. Reaction is neutral to moderately alkaline. The horizon is 10 to 20 inches thick.

The Bk horizon has hue of 10YR or 2.5Y, value of 6 to 8, and chroma of 1 to 3. Texture is silt loam, silty clay loam, gravelly silt loam, or gravelly silty clay loam.

Typic Eutroboralfs, Loamy-Skeletal, Mixed

Representative Pedon

O—2 inches to 0; duff and litter.
E1—0 to 2 inches; light brownish gray (10YR 6/2) gravelly silt loam; weak very fine granular structure; soft, very friable, slightly sticky and nonplastic; many fine roots; about 20 percent pebbles; neutral; clear wavy boundary.
E2—2 to 8 inches; pale brown (10YR 6/3) gravelly loam; moderate medium subangular blocky structure; hard, friable, slightly sticky and nonplastic; many fine and common coarse roots; about 30 percent pebbles; slightly acid; clear wavy boundary.
Bt—8 to 22 inches; yellowish brown (10YR 5/6) very gravelly clay loam; moderate medium subangular blocky structure; hard, firm, sticky and plastic; common fine and few coarse roots; common faint clay films on faces of peds; about 40 percent pebbles; slightly acid; abrupt wavy boundary.
Bk—22 to 60 inches; yellowish brown (10YR 5/4) very gravelly loam; weak moderate subangular blocky structure; hard, friable, slightly sticky and nonplastic; few medium roots on vertical cleavage planes; lime disseminated throughout and lime coatings on the underside of pebbles; violently effervescent; about 50 percent pebbles; moderately alkaline.

Location and Setting

Northwestern Montana, Lincoln County, Whitefish Range, Sink Creek, SW¼ sec. 9, T. 34 N., R. 25 W., detailed soil map unit 321. The profile described is on an east-facing slope on a moraine. Slope is 35 percent. The parent material is loamy, calcareous glacial till. Elevation is 3,600 feet. The vegetation is dry, mixed forest. The habitat type is Douglas-fir/snowberry.

Range in Characteristics

The E horizon has hue of 7.5YR, 10YR, or 2.5Y, value of 4 to 6, and chroma of 2 to 4. Texture is gravelly silt loam or gravelly loam. The horizon is 4 to 12 inches thick.

The Bt horizon has hue of 7.5YR, 10YR, or 2.5Y, value of 4 to 6, and chroma of 3 to 6. Texture is very gravelly clay loam or very gravelly silty clay loam. The content of rock fragments ranges from 35 to 50 percent. The horizon is 10 to 20 inches thick.

The Bk horizon has hue of 10YR or 2.5Y, value of 5 to 7, and chroma of 2 to 4. Texture is very gravelly loam, clay loam, or silty clay loam. In some pedons the horizon is dense and brittle and has bulk density of 1.5 to 1.8 grams per cubic centimeter.

Glossoboralfs

Glossoboralfs are the cool, non-base-saturated Boralfs of humid regions.

Eutric Glossoboralfs

Eutric Glossoboralfs are Glossoboralfs having albic material that does not tongue into the argillic horizon. They share common taxonomic boundaries with Eutroboralfs and Dystrochrepts. Some have base saturation near 60 percent. Others have a weakly expressed argillic horizon. These soils formed in glacial till or lacustrine material. They have a surface layer of loess that is influenced by volcanic ash. The surface layer is 4 to 14 inches thick.

Eutric Glossoboralfs, Fine, Illitic

Representative Pedon

O—1 inch to 0; dry grass and leaves.
E—0 to 9 inches; brown (10YR 5/3) silty clay loam; moderate medium subangular blocky structure; hard, firm, slightly sticky and plastic; common fine and medium roots; about 5 percent stones; moderately acid; clear wavy boundary.
B/E—9 to 18 inches; about 70 percent dark yellowish brown (10YR 4/4) silty clay (B) mixed with 30 percent yellowish brown (10YR 5/6) silty clay loam (E); strong fine and medium angular blocky structure; very hard, very firm, sticky and plastic; few fine roots; few faint clay films on faces of peds; moderately acid; gradual wavy boundary.
Bt—18 to 30 inches; brown (10YR 5/3) silty clay; strong medium and fine angular blocky structure; very hard, very firm, sticky and plastic; common distinct clay films on faces of peds; very strongly acid; gradual wavy boundary.
C—30 to 60 inches; brown (10YR 5/3) silty clay; strong medium angular blocky structure; very hard, very firm, sticky and plastic; very strongly acid.

Location and Setting

Northwestern Montana, Sanders County, Cabinet Range, Clark Fork Valley, Cabinet Ranger Station, SW¼ sec. 6, T. 24 N., R. 31 W., detailed soil map unit 112. The profile described is on the north-facing slope of a weakly dissected terrace. Slope is 10 percent. The parent material is moderately fine textured and fine textured lacustrine sediments. Elevation is 2,400 feet. The vegetation is moist, mixed coniferous forest. The habitat type is western hemlock/queencup beadlily.

Range in Characteristics

The E horizon has hue of 10YR or 2.5Y, value of 5 to 7, and chroma of 1 to 3. Texture is silt loam or silty clay

loam. Reaction is neutral to moderately acid. The horizon is 4 to 15 inches thick.

The B/E horizon has hue of 10YR or 2.5Y, value of 4 to 7, and chroma of 1 to 6. Texture is silt loam or silty clay loam. Reaction is neutral to moderately acid. The horizon is 5 to 10 inches thick.

The Bt horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 3 to 6. Texture is silty clay loam or silty clay. The content of clay ranges from 35 to 55 percent. Reaction is slightly acid to very strongly acid. The horizon is 10 to 30 inches thick.

The C horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 3 to 6. Texture is silty clay loam or silty clay. Reaction is slightly acid to very strongly acid.

Eutric Glossoboralfs, Fine, Mixed

Representative Pedon

O—3 inches to 0; duff and litter.

Bs—0 to 9 inches; light yellowish brown (10YR 6/4) gravelly silt loam; moderate medium subangular blocky structure parting to moderate medium granular; soft, friable, slightly sticky and nonplastic; many very fine and fine and common medium and coarse roots; about 25 percent pebbles; neutral; clear wavy boundary.

2E—9 to 18 inches; light gray (10YR 7/2) gravelly silt loam; weak medium subangular blocky structure parting to moderate medium granular; friable, slightly sticky and slightly plastic; many very fine and fine and common medium and coarse roots; about 30 percent pebbles; neutral; clear wavy boundary.

2Bt—18 to 28 inches; very pale brown (10YR 7/4) gravelly clay loam; strong medium and coarse subangular blocky structure; slightly hard, firm, sticky and plastic; common very fine and fine and few medium and coarse roots; about 30 percent pebbles; common faint clay films on faces of peds; neutral; clear wavy boundary.

2CBd—28 to 60 inches; yellowish brown (10YR 5/8) gravelly clay loam; white (10YR 8/2) sand and silt coatings on peds; strong medium and coarse subangular blocky structure; hard, firm, sticky and plastic; few very fine and fine roots; about 30 percent pebbles; neutral.

Location and Setting

Northwestern Montana, Lincoln County, Purcell Range, Marias Mountain, sec. 30, T. 37 N., R. 28 W., detailed soil map unit 322. The profile described is on a south-facing slope on a moraine. Slope is 20 percent. The parent material is loess over weathered glacial till. The loess has been influenced by volcanic ash. Elevation is 4,800 feet. The vegetation is moist, mixed coniferous forest. The habitat type is western redcedar/queencup beadlily.

Range in Characteristics

The Bs horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 3 to 5. Texture is silt loam or gravelly silt loam. Reaction is neutral or slightly acid. The horizon is 4 to 18 inches thick.

The 2E horizon has hue of 7.5YR or 10YR, value of 5 to 7, and chroma of 1 to 3. Texture is silt loam, loam, gravelly silt loam, or gravelly loam. Reaction is neutral or slightly acid. The horizon is 6 to 12 inches thick.

The 2Bt horizon has hue of 7.5YR or 10YR, value of 4 to 7, and chroma of 3 to 6. Texture is gravelly clay loam or gravelly clay. The content of clay ranges from 35 to 45 percent. Reaction is neutral to moderately acid. The horizon is 8 to 24 inches thick.

The 2CBd horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 4 to 8. Texture is gravelly clay loam or gravelly clay. Reaction is neutral to moderately acid. Bulk density is 1.5 to 1.8 grams per cubic centimeter.

Fluvents

Fluvents are on flood plains. The content of organic carbon in these soils decreases irregularly with increasing depth because of the flooding and the buried former surface layers. Fluvents are texturally stratified. They are of limited extent in the survey area.

Fluvents

Representative Pedon

O—2 inches to 0; black (10YR 2/1) duff and litter.

A—0 to 9 inches; dark yellowish brown (10YR 4/4) gravelly silt loam; weak fine granular structure; loose, friable, slightly sticky and nonplastic; common very fine and fine, many medium, and few coarse roots; about 15 percent pebbles; slightly acid; clear wavy boundary.

C1—9 to 15 inches; yellowish brown (10YR 5/4) very gravelly sandy loam; massive; soft, friable, nonsticky and nonplastic; common very fine and fine, many medium, and few coarse roots; about 50 percent pebbles; slightly acid; abrupt smooth boundary.

C2—15 to 19 inches; yellowish brown (10YR 5/6) sandy loam; massive; soft, friable, nonsticky and nonplastic; few very fine and fine, common medium, and few coarse roots; about 5 percent pebbles; slightly acid; abrupt smooth boundary.

C3—19 to 60 inches; yellowish brown (10YR 5/6) sand;

single grain; loose, nonsticky and nonplastic; moderately acid.

Location and Setting

Northwestern Montana, Lincoln County, Cabinet Mountains, Bull Lake, sec. 20, T. 29 N., R. 33 W., detailed soil map unit 101. The profile described is a sandy, mixed, frigid Typic Udifluvent. It is on a nearly level flood plain along a stream. The parent material is texturally stratified alluvium. Elevation is about 2,500 feet. The vegetation is moist, mixed coniferous forest. The habitat type is western hemlock/queencup beadlily.

Range in Characteristics

The A horizon has hue of 7.5YR, 10YR, or 2.5Y, value of 3 to 6, and chroma of 2 to 6. Texture is silt loam, loam, or sandy loam. The content of rock fragments ranges from 0 to 60 percent. Reaction is neutral to moderately acid. The horizon is 2 to 12 inches thick.

The C horizon has hue of 7.5YR, 10YR, or 2.5Y, value of 3 to 6, and chroma of 2 to 6. Texture is stratified sand, loamy sand, sandy loam, loam, or silt loam. The content of rock fragments ranges from 0 to 75 percent.

Udifluvents

Udifluvents are the Fluvents of humid climates. They are moist in spring and early summer and are dry for fewer than 90 days in late summer and fall.

Aquic Udifluvents

Aquic Udifluvents are Fluvents that are wet. They have a water table that rises to the surface in the spring and drops in late summer. The ground water is well aerated. Aquic Udifluvents are mottled with colors having chroma of 3 or more.

Aquic Udifluvents, Coarse-Loamy, Mixed, Frigid

Representative Pedon

O—1 inch to 0; duff and litter.

A—0 to 7 inches; very dark grayish brown (10YR 3/2) silt loam; weak fine granular structure; soft, very friable, slightly sticky and nonplastic; common very fine and many fine roots; about 5 percent pebbles; slightly acid; clear wavy boundary.

C1—7 to 14 inches; very pale brown (10YR 7/4) very gravelly sandy loam; few fine distinct brownish yellow (10YR 6/6) mottles; weak fine and medium granular structure; loose, nonsticky and nonplastic; common very fine and fine roots; about 60 percent pebbles; slightly acid; gradual wavy boundary.

C2—14 to 19 inches; very pale brown (10YR 7/4) extremely gravelly sandy loam; few fine distinct brownish yellow (10YR 6/6) mottles; weak fine and medium granular structure; loose, nonsticky and nonplastic; common very fine and fine roots; about 65 percent pebbles; slightly acid; abrupt smooth boundary.

2C3—19 to 24 inches; light reddish brown (2.5YR 6/4) silt loam; few fine distinct strong brown (7.5YR 5/6) mottles; massive; slightly hard, friable, nonsticky and nonplastic; few very fine and fine roots; neutral; clear wavy boundary.

2C4—24 to 60 inches; light reddish brown (2.5YR 6/4) fine sandy loam; few fine distinct strong brown (7.5YR 5/6) mottles; weak fine granular structure; slightly hard, friable, nonsticky and nonplastic; few very fine roots; moderately acid.

Location and Setting

Northwestern Montana, Lincoln County, Cabinet Range, in the Bull River drainage area, NW¼ sec. 34, T. 31 N., R. 33 W., detailed soil map unit 105. The profile described is on a nearly level flood plain. The parent material is texturally stratified alluvium. Elevation is about 2,800 feet. The vegetation is a wet meadow.

Range in Characteristics

The A horizon has hue of 10YR or 2.5Y and value and chroma of 1 to 3. Texture is loam, silt loam, or sandy loam. Reaction is neutral or slightly acid. The horizon is 4 to 10 inches thick.

The C horizon has hue of 2.5YR to 5Y, value of 4 to 7, and chroma of 3 to 6. It generally is mottled. Texture is very gravelly sandy loam, extremely gravelly sandy loam, silt loam, or fine sandy loam. The content of rock fragments dominantly is 0 to 35 percent but ranges to 85 percent in thin strata. Reaction is neutral to moderately acid.

Ochrepts

Ochrepts are soils having a light colored surface layer and not having a substantial accumulation of clay in the subsoil or a surface layer of loess influenced by volcanic ash that is thick enough to qualify for the Andept suborder. They are relatively young soils with some evidence of alteration of parent material and redistribution of minerals within the soil profile. They are expected, given time and proper conditions, to develop into soils representative of some other soil order.

Cryochrepts

Cryochrepts are the cold Ochrepts. They are at elevations of 4,500 to 8,700 feet and are in the 40- to

80-inch precipitation zone. The vegetation is mainly subalpine fir climax forest.

Andic Cryochrepts

Andic Cryochrepts are Cryochrepts having a surface layer of loess that has been influenced by volcanic ash. The surface layer is 7 to 14 inches thick. It has a bulk density of 0.7 to 1.0 gram per cubic centimeter. The parent material of the subsoil is derived from granitic rocks, metasedimentary rocks, or glacial till. Andic Cryochrepts share common taxonomic boundaries with Andic Dystrochrepts and Lithic Cryochrepts. They also share taxonomic boundaries with Entic Cryandepts and Typic Cryochrepts, which are included in some map units as similar soils. Their surface layer provides the best rooting environment in the soil profile. It can be damaged by equipment used in forest management.

Andic Cryochrepts, Loamy-Skeletal, Mixed

Representative Pedon

O—2 inches to 0; duff and litter.

Bs—0 to 8 inches; dark brown (10YR 4/3) silt loam; moderate medium subangular blocky structure parting to moderate medium granular; soft, friable, nonsticky and nonplastic; many fine and very fine and common medium and coarse roots; about 5 percent stones; moderately acid; clear wavy boundary.

2Bw1—8 to 16 inches; yellowish brown (10YR 5/4) very stony silt loam; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and nonplastic; many very fine and fine and few medium roots; about 35 percent stones; moderately acid; clear wavy boundary.

2Bw2—16 to 41 inches; light olive brown (2.5Y 5/4) very stony silt loam that has pockets of dark grayish brown (2.5Y 4/2) sandy loam; moderate coarse and medium subangular blocky structure; slightly hard, friable, slightly sticky and nonplastic; common very fine and few medium roots; about 45 percent stones; slightly acid; clear wavy boundary.

2C—41 to 60 inches; dark grayish brown (2.5Y 4/2) very stony sandy loam; massive; slightly hard, friable, slightly sticky and nonplastic; few medium roots; about 50 percent stones; slightly acid.

Location and Setting

Northwestern Montana, Lincoln County, Purcell Range, in the Yaak River drainage area, Caribou Creek, SE¼ sec. 16, T. 37 N., R. 30 W., detailed soil map unit 404. The profile described is on an east-facing slope on a moraine. Slope is 20 percent. The parent material is loess over friable glacial till. The loess has been influenced by volcanic ash. Elevation is 4,500 feet. The vegetation is moist, mixed coniferous forest. The habitat type is subalpine fir/queencup beadlily.

Range in Characteristics

The Bs horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 3 to 5. Texture is silt loam or very fine sandy loam. Reaction is slightly acid or moderately acid. The horizon is 7 to 14 inches thick.

The 2Bw horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 2 to 6. Texture is silt loam, loam, or fine sandy loam. The content of rock fragments ranges from 35 to 60 percent. Reaction is moderately alkaline to moderately acid. The horizon is 25 to 40 inches thick.

The 2C or 2Cd horizon has hue of 2.5Y or 10YR, value of 4 to 6, and chroma of 2 to 4. Texture is silt loam, loam, or sandy loam. The content of rock fragments ranges from 35 to 70 percent. Reaction is slightly acid or moderately acid. In some pedons the horizon is dense and brittle and has bulk density of 1.5 to 1.8 grams per cubic centimeter.

Lithic Cryochrepts

Lithic Cryochrepts are Cryochrepts that have bedrock within 20 inches of the surface. In this survey area they generally have a surface layer of loess that has been influenced by volcanic ash. The surface layer is 7 to 14 inches thick. It has a bulk density of 0.7 to 1.0 gram per cubic centimeter. The parent material of the subsoil dominantly is derived from metasedimentary rocks. In a few pedons the subsoil formed in a thin layer of glacial till over bedrock. Lithic Cryochrepts are at elevations of 3,500 to 8,000 feet. They are on all aspects. They share common taxonomic boundaries with Andic Cryochrepts, Typic Cryochrepts, and Lithic Dystrochrepts. Their surface layer provides the best rooting environment in the soil profile. It is susceptible to compaction and can be easily displaced. Compaction and displacement of the surface layer can affect plant growth.

Lithic Cryochrepts, Loamy-Skeletal, Mixed

Representative Pedon

O—1 inch to 0; litter and duff.

A—0 to 8 inches; yellowish brown (10YR 5/6) stony silt loam; weak medium subangular blocky structure parting to moderate medium granular; soft, friable, nonsticky and nonplastic; many very fine, fine, medium, and coarse roots; about 15 percent stones; slightly acid; abrupt wavy boundary.

Bw—8 to 19 inches; pale brown (10YR 6/3) very stony silt loam; moderate medium subangular blocky

structure parting to moderate medium granular; slightly hard, friable, slightly sticky and nonplastic; common very fine, fine, and medium and few coarse roots; about 40 percent stones; slightly acid; abrupt wavy boundary.
R—19 inches; bedrock.

Location and Setting

Northwestern Montana, Lincoln County, Purcell Range, Solo Joe Creek, sec. 1, T. 36 N., R. 30 W., detailed soil map unit 405. The profile described is on a south-facing slope on a glaciated mountain ridge. Slope is 50 percent. The parent material is loess mixed with material derived from metasedimentary rocks. The loess has been influenced by volcanic ash. Elevation is 5,600 feet. The vegetation is subalpine forest. The habitat type is subalpine fir/beargrass.

Range in Characteristics

The A horizon has hue of 7.5YR or 10YR, value of 3 to 6, and chroma of 2 to 6. Texture is silt loam or very fine sandy loam. The content of rock fragments ranges from 0 to 35 percent. Reaction is neutral or slightly acid. The horizon is 2 to 10 inches thick.

The Bw horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 3 to 6. Texture is silt loam, very fine sandy loam, or fine sandy loam. The content of rock fragments ranges from 35 to 80 percent. Reaction is slightly acid or moderately acid. The horizon is 4 to 18 inches thick.

Dystrochrepts

Dystrochrepts are the acid Ochrepts of humid environments. In this survey area they are on south-facing slopes or at low elevations. They are in the 25- to 40-inch precipitation zone at elevations of 2,500 to 5,000 feet. The vegetation is mixed coniferous forest. The habitat types are in the western redcedar, western hemlock, grand fir, and Douglas-fir series. Dystrochrepts are productive forest soils because of their relatively warm temperature.

Andic Dystrochrepts

Andic Dystrochrepts are Dystrochrepts having a surface layer of loess that has been influenced by volcanic ash. The surface layer is 7 to 14 inches thick. The bulk density of the surface layer is 0.7 to 1.0 gram per cubic centimeter. The parent material of the subsoil is derived from metasedimentary rocks, granitic rocks, glacial drift, alluvium, or lacustrine deposits. Andic Dystrochrepts share common taxonomic boundaries with Typic Ustochrepts, Typic Vitrandepts, Andic Dystric Eutrochrepts, and Andic Cryochrepts. The subsoil generally has a base saturation of nearly 60 percent. Andic Dystrochrepts are productive forest soils. They generally receive an adequate amount of moisture, but some areas of these soils are dry for short periods in late summer. The surface layer provides the best rooting environment in the soil profile. It can be damaged by equipment used in forest management.

Andic Dystrochrepts, Loamy-Skeletal, Mixed, Frigid

Representative Pedon

O—1 inch to 0; duff and litter.
Bs—0 to 7 inches; yellowish brown (10YR 5/4) gravelly silt loam; weak fine granular structure; loose, friable, nonsticky and nonplastic; common fine and coarse and many medium roots; about 25 percent pebbles; very strongly acid; abrupt wavy boundary.
2A—7 to 20 inches; very pale brown (10YR 7/3) very gravelly very fine sandy loam; massive; hard, very friable, nonsticky and nonplastic; common fine and few medium and coarse roots; about 40 percent pebbles; very strongly acid; clear wavy boundary.
2Bw—20 to 41 inches; strong brown (7.5YR 5/8) very gravelly very fine sandy loam; weak coarse angular blocky structure; hard, friable, nonsticky and nonplastic; few medium roots; about 45 percent pebbles; strongly acid; clear wavy boundary.
2Cd—41 to 62 inches; pale brown (10YR 6/3) very gravelly very fine sandy loam; massive; hard, brittle, nonsticky and nonplastic; about 50 percent pebbles; moderately acid.

Location and Setting

Northwestern Montana, Lincoln County, Salish Range, Briery Creek, sec. 14, T. 34 N., R. 28 W., detailed soil map unit 352. The profile described is on a south-facing glaciated mountain slope. Slope is 20 percent. The parent material is loess over compact glacial till. The loess has been influenced by volcanic ash. Elevation is 5,000 feet. The vegetation is moist, mixed coniferous forest. The habitat type is subalpine fir/blue huckleberry.

Range in Characteristics

The Bs horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 3 to 5. Texture is silt loam or very fine sandy loam. The content of rock fragments ranges from 0 to 30 percent. Reaction is slightly acid to very strongly acid. The horizon is 7 to 14 inches thick.

The 2A horizon has hue of 10YR or 2.5Y, value of 5 to 7, and chroma of 1 to 3. Texture is silt loam, very fine sandy loam, or fine sandy loam. The content of rock fragments ranges from 35 to 70 percent. Reaction is slightly acid to strongly acid. The horizon is 7 to 12 inches thick.

The 2Bw horizon has hue of 7.5YR, 10YR, or 2.5Y, value of 4 to 6, and chroma of 4 to 8. Texture is very fine sandy loam or fine sandy loam. The content of rock fragments ranges from 35 to 50 percent. Reaction is slightly acid to strongly acid. The horizon is 15 to 30 inches thick.

The 2Cd or 2C horizon has hue of 7.5YR, 10YR, or 2.5Y, value of 5 to 7, and chroma of 2 to 5. Texture is very fine sandy loam, sandy loam, loamy sand, or sand. The content of rock fragments ranges from 35 to 70 percent. Reaction is slightly acid or moderately acid. In areas where the soils formed in compact glacial till, this horizon is dense and brittle and has bulk density of 1.5 to 1.8 grams per cubic centimeter.

Eutrochrepts

Eutrochrepts are Ochrepts of humid environments. They are rich in bases. In this survey area they are in the 25- to 40-inch precipitation zone at elevations of 2,000 to 5,000 feet. Eutrochrepts formed in parent material that contains lime. The typical parent material is lacustrine material mixed with glacial till that is partially derived from limestone or metasedimentary rocks. These soils are most common in areas below an elevation of 3,000 feet where leaching is less intense. The typical vegetation is moist, mixed forest.

Eutrochrepts, Coarse-Loamy, Mixed, Frigid

Representative Pedon

O—1 inch to 0; duff and litter.

Bs—0 to 11 inches; dark yellowish brown (10YR 4/6) silt loam; weak fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; many very fine and fine, common medium, and common coarse roots; slightly acid; clear wavy boundary.

2Bw—11 to 35 inches; yellowish brown (10YR 5/4) very fine sandy loam; very weak medium subangular blocky structure; very friable, nonsticky and nonplastic; many very fine and fine and few medium roots; slightly effervescent, moderately alkaline; gradual wavy boundary.

2C—35 to 60 inches; brown (10YR 5/3) very fine sandy loam; massive; soft, very friable, nonsticky and nonplastic; few very fine, fine, and medium roots; slightly effervescent, moderately alkaline.

Location and Setting

Northwestern Montana, Lincoln County, Cabinet Range, Lake Creek, sec. 29, T. 31 N., R. 33 W., detailed soil map unit 110. The profile described is on an undulating terrace. The parent material is loess over glacial outwash. The glacial outwash has been reworked by wind. The loess has been influenced by volcanic ash. Elevation is about 2,200 feet. The vegetation is moist, mixed coniferous forest. The habitat type is western hemlock/queencup beadlily.

Range in Characteristics

The Bs horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 3 to 6. Texture is very fine sandy loam or silt loam. Reaction is slightly acid or moderately acid. The horizon is 7 to 14 inches thick.

The 2Bw horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 3 to 6. Texture is very fine sandy loam or loamy very fine sand. Reaction is slightly alkaline or moderately alkaline. This horizon dominantly is slightly effervescent or moderately effervescent. It is 10 to 30 inches thick.

The 2C horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 2 to 6. Texture is very fine sandy loam or loamy very fine sand. Reaction is neutral to moderately alkaline. This horizon is slightly effervescent or moderately effervescent.

Andic Dystric Eutrochrepts

Andic Dystric Eutrochrepts are freely drained Eutrochrepts having a surface layer of loess that has been influenced by volcanic ash and not having free carbonates above a depth of 40 inches. The surface layer is 7 to 14 inches thick. These soils formed in calcareous parent material in moist climates or in noncalcareous parent material in the drier climates. Because of additional leaching in soils formed under moist climate conditions, free carbonates are deeper in soil profiles formed under moist climate conditions than those formed under the drier climate conditions. Andic Dystric Eutrochrepts share common taxonomic boundaries with Dystric Eutrochrepts and Typic Eutrochrepts. They are productive forest soils. Their surface layer provides the best rooting environment in the soil profile. It can be damaged by equipment used in forest management.

Andic Dystric Eutrochrepts, Fine-Silty, Mixed, Frigid

Representative Pedon

O—1 inch to 0; duff and litter.

Bs—0 to 9 inches; light yellowish brown (10YR 6/4) silt loam; weak fine granular structure; very friable, slightly sticky and nonplastic; many very fine, fine, and medium roots; about 5 percent pebbles; neutral; clear wavy boundary.

2A—9 to 14 inches; white (10YR 8/2) silt loam; moderate medium subangular blocky structure;

slightly hard, firm, slightly sticky and nonplastic; slightly acid; clear wavy boundary.
2AB—14 to 31 inches; white (10YR 8/2) silt loam; common fine distinct pale yellow (2.5Y 7/4) mottles; moderate coarse subangular blocky structure; slightly hard, firm, sticky and nonplastic; common fine roots; moderately acid; clear wavy boundary.
2Bw—31 to 56 inches; pale yellow (2.5Y 7/4) very fine sandy loam; weak coarse subangular blocky structure; slightly hard, firm, slightly sticky and nonplastic; few fine roots; strongly acid; abrupt wavy boundary.
2BC—56 to 60 inches; white (2.5Y 8/2) very fine sandy loam; weak coarse subangular blocky structure; very hard, very firm, sticky and plastic; neutral.

Location and Setting

Northwestern Montana, Lincoln County, Cabinet Range, in the Callahan Creek drainage area, sec. 21, T. 31 N., R. 34 W., detailed soil map unit 102. The profile described is on a gently sloping terrace. The parent material is loess over lacustrine sediments. The loess has been influenced by volcanic ash. Elevation is about 2,600 feet. The vegetation is moist, mixed forest. The habitat type is western redcedar/queencup beadlily.

Range in Characteristics

The Bs horizon has hue of 7.5YR or 10YR and value and chroma of 4 to 6. Texture is silt loam or very fine sandy loam. Reaction is neutral or slightly acid. The horizon is 7 to 14 inches thick.

The 2A horizon has hue of 10YR or 2.5Y, value of 4 to 8, and chroma of 2 to 4. Texture is silt loam, very fine sandy loam, or silty clay loam. Reaction is slightly acid or neutral. The horizon is 5 to 10 inches thick.

The 2AB horizon has colors similar to those of the 2A horizon. It is 5 to 20 inches thick.

The 2Bw horizon has hue of 10YR or 2.5Y, value of 5 to 7, and chroma of 3 to 6. Texture is silt loam, silty clay loam, or very fine sandy loam. Reaction is neutral to strongly acid. The horizon is 15 to 30 inches thick.

The 2BC horizon has hue of 10YR or 2.5Y, value of 5 to 8, and chroma of 1 to 4. Texture is silt loam, silty clay loam, or very fine sandy loam. Reaction is neutral to moderately acid.

Andic Dystric Eutrochrepts, Sandy, Micaceous, Frigid

Representative Pedon

O—1 inch to 0; duff and litter.
Bs—0 to 9 inches; dark grayish brown (10YR 4/2) very fine sandy loam; weak fine granular structure; soft, friable, nonsticky and nonplastic; many very fine and fine, common medium, and many coarse roots; about 5 percent pebbles; neutral; clear smooth boundary.
2Bw—9 to 18 inches; olive (5Y 4/4) very gravelly coarse sandy loam; weak fine subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; common very fine and fine, many medium, and common coarse roots; about 55 percent pebbles; neutral; clear wavy boundary.
2CB—18 to 40 inches; olive gray (5Y 4/2) gravelly loamy sand; very weak medium subangular blocky structure; soft, friable, nonsticky and nonplastic; few fine, medium, and coarse roots; about 25 percent pebbles; neutral; gradual wavy boundary.
2C—40 to 60 inches; mixed dark yellowish brown (10YR 4/4), red (2.5YR 4/6), and yellow (10YR 7/6) sand; single grain; loose, nonsticky and nonplastic; few medium and coarse roots; neutral.

Location and Setting

Northwestern Montana, Lincoln County, Purcell Range, in the Rainy Creek drainage area, SE¼ sec. 14, T. 31 N., R. 30 W., detailed soil map unit 520. The profile described is on a mountain slope. Slope is 25 percent. The parent material is loess over micaceous material derived from pyroxenite. The loess has been influenced by volcanic ash. The vegetation is moist, mixed forest. The habitat type is grand fir/queencup beadlily.

Range in Characteristics

The Bs horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 2 to 4. Texture is silt loam or very fine sandy loam. Reaction is neutral or slightly acid. The horizon is 7 to 14 inches thick.

The 2Bw horizon has hue of 10YR to 5Y and value and chroma of 4 to 6. Texture is sandy loam or coarse sandy loam. The content of rock fragments ranges from 15 to 55 percent. Reaction is neutral or slightly acid.

The 2CB and 2C horizons have of 10YR to 5Y, value of 4 to 7, and chroma of 2 to 6. Texture is loamy sand or sand. The content of rock fragments ranges from 0 to 35 percent. Reaction is neutral or slightly acid.

Dystric Eutrochrepts

Dystric Eutrochrepts are freely drained Eutrochrepts that do not have free carbonates above a depth of 40 inches. They share common taxonomic boundaries with Andic Dystric Eutrochrepts, Typic Eutrochrepts, and Typic Xerochrepts. In some pedons they have free carbonates below a depth of 40 inches. They are dry during mid and late summer. Dystric Eutrochrepts are productive forest soils; however, regeneration is limited because of drought in late summer.

Dystric Eutrochrepts, Loamy-Skeletal, Mixed, Frigid

Representative Pedon

O—1 inch to 0; duff and litter.
A—0 to 4 inches; brown (10YR 5/3) gravelly silt loam; weak fine granular structure; soft, friable, slightly sticky and nonplastic; many very fine, fine, and medium roots; about 30 percent pebbles; slightly acid; clear wavy boundary.
Bw1—4 to 11 inches; white (10YR 8/2) gravelly silt loam; weak fine subangular blocky structure; slightly hard, friable, slightly sticky and nonplastic; common medium and coarse roots; about 30 percent pebbles; slightly acid; gradual wavy boundary.
Bw2—11 to 28 inches; light gray (2.5Y 7/1) very gravelly fine sandy loam; moderate medium subangular blocky structure; hard, firm, slightly sticky and nonplastic; common fine and medium roots; about 50 percent pebbles; moderately acid; gradual wavy boundary.
Bt—28 to 39 inches; light gray (5Y 7/2) very gravelly fine sandy loam having bands of light yellowish brown (2.5Y 6/4); moderate medium subangular blocky structure; hard, friable, slightly sticky and nonplastic; few fine and medium roots; about 50 percent pebbles; few faint clay films on faces of peds; neutral; clear wavy boundary.
BCd—39 to 60 inches; light gray (10YR 7/1) very gravelly fine sandy loam having bands of light olive brown (2.5Y 5/6); massive; hard, brittle, nonsticky and nonplastic; few fine roots; few faint clay films on faces of peds; about 50 percent pebbles; neutral.

Location and Setting

Northwestern Montana, Lincoln County, Salish Range, in the Dunn Creek drainage area, sec. 2, T. 30 N., R. 29 W., detailed soil map unit 301. The profile described is on a south-facing slope on a moraine. Slope is 35 percent. The parent material is glacial till. Elevation is 3,080 feet. The vegetation is dry, mixed forest. The habitat type is Douglas-fir/bearberry.

Range in Characteristics

The A horizon has hue of 10YR or 2.5Y, value of 3 to 5, and chroma of 2 or 3. Texture is silt loam or very fine sandy loam. The content of rock fragments ranges from 15 to 35 percent. Reaction is neutral or slightly acid. The horizon is 2 to 6 inches thick.

The Bw and Bt horizons have hue of 10YR to 5Y, value of 5 to 7, and chroma of 1 to 3. Texture is silt loam, loam, very fine sandy loam, or fine sandy loam. The content of rock fragments ranges from 35 to 50 percent. Reaction is neutral or slightly alkaline. The combined thickness of the horizons is 10 to 30 inches.

The BC horizon has hue of 10YR to 5Y, value of 5 to 7, and chroma of 1 to 3. Texture is silt loam, loam, very fine sandy loam, fine sandy loam, or loamy sand. The content of rock fragments ranges from 35 to 50 percent. Reaction is neutral to moderately alkaline. In some pedons the horizon is effervescent below a depth of 40 inches. In other pedons it is hard and brittle and has bulk density of 1.5 to 1.8 grams per cubic centimeter.

Typic Eutrochrepts

Typic Eutrochrepts are the freely drained Eutrochrepts that have free carbonates within 40 inches of the surface. They represent the central concept or typical member of the Eutrochrepts great group. They formed in calcareous glacial till. They share common taxonomic boundaries with Dystric Eutrochrepts and Typic Xerochrepts. Forest regeneration is limited in areas of these soils because of drought in late summer.

Typic Eutrochrepts, Loamy-Skeletal, Mixed, Frigid

Representative Pedon

O—2 inches to 0; duff and litter.
A1—0 to 3 inches; light brownish gray (10YR 6/2) silt loam; weak fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine and fine and common medium roots; about 10 percent pebbles; slightly alkaline; abrupt wavy boundary.
A2—3 to 16 inches; light olive brown (2.5Y 5/4) silt loam; weak fine granular structure; soft, friable, nonsticky and nonplastic; many fine, common medium, and few coarse roots; about 10 percent pebbles; slightly alkaline; clear wavy boundary.
Bw—16 to 23 inches; brown (10YR 5/3) very gravelly silt loam; weak fine subangular blocky structure; soft, friable, nonsticky and nonplastic; common fine and medium roots; about 35 percent pebbles; strongly effervescent, moderately alkaline; clear wavy boundary.
Ck1—23 to 30 inches; yellowish brown (10YR 5/4) very gravelly silt loam; massive; soft, friable, slightly sticky and nonplastic; few fine, medium, and coarse roots; about 45 percent pebbles; lime disseminated throughout and lime coatings on the underside of pebbles; violently effervescent, moderately alkaline; clear wavy boundary.
Ck2—30 to 60 inches; light olive brown (2.5Y 5/4) very gravelly fine sandy loam; massive; hard, friable, nonsticky and nonplastic; few fine, medium, and coarse roots; about 40 percent pebbles; lime disseminated throughout and lime coatings on the

underside of pebbles; violently effervescent, moderately alkaline.

Location and Setting

Northwestern Montana, Lincoln County, Salish Range, Black Butte, sec. 25, T. 35 W., R. 28 W., detailed soil map unit 324. The profile described is on a south-facing slope on a moraine. Slope is 10 percent. The parent material is calcareous glacial till. Elevation is 3,000 feet. The vegetation is dry, mixed forest. The habitat type is Douglas-fir/pinegrass.

Range in Characteristics

The A horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 2 to 6. Texture is silt loam or loam. The content of rock fragments ranges from 10 to 20 percent. Reaction is neutral or slightly alkaline.

The Bw horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 2 to 6. Texture is silt loam or loam. The content of rock fragments ranges from 35 to 50 percent. Reaction is slightly alkaline or moderately alkaline. The horizon is slightly effervescent to violently effervescent. It is 4 to 15 inches thick.

The Ck horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 2 to 6. Texture is silt loam, loam, or fine sandy loam. The content of rock fragments ranges from 35 to 50 percent.

Ustochrepts

Ustochrepts are the Ochrepts of subhumid climates. They are moist in spring and early summer and dry for fewer than 45 consecutive days in late summer and early fall. In this survey area they are at the lower elevations on south-facing slopes. They are on mountain slopes or glaciated mountain slopes at elevations of 2,400 to 5,000 feet. They formed in glacial till or residuum. The vegetation is dry, mixed forest or open-grown forest. Forest stands are mainly mixed Douglas-fir and ponderosa pine with western larch and lodgepole pine included in areas along drainageways and at the highest elevations.

Lithic Ustochrepts

Lithic Ustochrepts are the Ustochrepts that have bedrock within 20 inches of the surface. They formed in material derived from metasedimentary rocks or in glacial till. Most of these soils have a surface layer that formed in loess and residuum from the underlying material. The loess has been influenced by volcanic ash. Lithic Ustochrepts share common taxonomic boundaries with Typic Ustochrepts, Lithic Cryochrepts, and Andic Dystrochrepts. The growth of trees is limited by the depth of the soils.

Lithic Ustochrepts, Loamy-Skeletal, Mixed, Frigid

Representative Pedon

O—1 inch to 0; duff and litter.

A—0 to 6 inches; brown (10YR 5/3) very cobbly sandy loam; weak fine granular structure; soft, very friable, slightly sticky and nonplastic; about 50 percent angular cobbles; slightly acid; clear wavy boundary.

Bw1—6 to 12 inches; light yellowish brown (10YR 6/4) very cobbly sandy loam; weak fine granular structure; soft, very friable, slightly sticky and nonplastic; about 50 percent angular cobbles; moderately acid; clear wavy boundary.

Bw2—12 to 19 inches; light brownish gray (10YR 6/2) extremely cobbly fine sandy loam; moderate medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; about 70 percent angular cobbles; gradual wavy boundary.

R—19 inches; hard, fractured quartzite bedrock.

Location and Setting

Northwestern Montana, Lincoln County, Cabinet Range, Swede Mountain Divide, NW¼ sec. 28, T. 30 N., R. 30 W., detailed soil map unit 303. The profile described is on a glaciated mountain ridge. Slope is 35 percent. The parent material is loess mixed with material derived from metasedimentary rocks. The loess has been influenced by volcanic ash. Elevation is 4,000 feet. The vegetation is open-grown forest. The habitat type is Douglas-fir/bluebunch wheatgrass.

Range in Characteristics

The A horizon has hue of 7.5YR or 10YR, value of 2 to 5, and chroma of 2 to 4. Texture is silt loam, very fine sandy loam, or sandy loam. The content of rock fragments ranges from 25 to 60 percent. Reaction is slightly acid or moderately acid. The horizon is 3 to 8 inches thick.

The Bw horizon has hue of 7.5YR, 10YR, or 2.5Y, value of 4 to 7, and chroma of 2 to 5. Texture is silt loam, very fine sandy loam, sandy loam, or fine sandy loam. The content of rock fragments ranges from 35 to 80 percent. Fractured bedrock is 7 to 20 inches below the surface.

Typic Ustochrepts

Typic Ustochrepts formed in noncalcareous till or in material derived from metasedimentary or granitic rocks. Most of these soils have a surface layer that formed in loess and residuum from the underlying material. The loess has been influenced by volcanic ash. Typic Ustochrepts share common taxonomic boundaries with Andic Dystrochrepts, Andic Dystric

Eutrochrepts, and Lithic Ustochrepts. They are moderately productive forest soils. Forest regeneration is limited by solar insolation.

Typic Ustochrepts, Loamy-Skeletal, Mixed, Frigid

Representative Pedon

O—0.5 inch to 0; discontinuous duff and litter.
A—0 to 8 inches; dark gray (10YR 4/1) very gravelly very fine sandy loam; moderate fine granular structure; soft, friable, slightly sticky and slightly plastic; many fine and medium and few coarse roots; about 35 percent angular pebbles; neutral; clear wavy boundary.
Bw—8 to 27 inches; gray (2.5Y 5/0) very gravelly very fine sandy loam; weak fine subangular blocky structure; hard, friable, nonsticky and nonplastic; common fine and medium and few coarse roots; about 70 percent angular pebbles; slightly acid; gradual wavy boundary.
C—27 to 45 inches; gray (2.5Y 5/0) very gravelly very fine sandy loam; massive; hard, friable, nonsticky and nonplastic; few fine and medium roots; about 75 percent angular pebbles; slightly acid; abrupt wavy boundary.
R—45 inches; hard, fractured quartzite bedrock.

Location and Setting

Northwestern Montana, Lincoln County, Sutton area, SE¼NE¼ sec. 30, T. 35 N., R. 28 W., detailed soil map unit 201. The profile described is on a south-facing mountain slope. Slope is 65 percent. The parent material is residuum derived from metasedimentary rocks. Elevation is 3,700 feet. The vegetation is an open-grown stand of ponderosa pine and Douglas-fir with a patchy understory of bitterbrush, bearberry, and bluebunch wheatgrass on a forested scree community type.

Range in Characteristics

The A horizon has hue of 10YR or 2.5Y or is neutral in hue. It has value of 4 to 6 and chroma of 0 to 4. Texture is silt loam, loam, very fine sandy loam, or fine sandy loam. The content of rock fragments ranges from 15 to 50 percent. The horizon is 4 to 12 inches thick.

The Bw horizon has hue of 10YR or 2.5Y or is neutral in hue. It has value of 4 to 6 and chroma of 0 to 4. Texture is very fine sandy loam or fine sandy loam. The content of rock fragments ranges from 35 to 80 percent. The horizon is 12 to 30 inches thick.

The C horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 to 4. Texture is very fine sandy loam or fine sandy loam. The content of rock fragments ranges from 35 to 85 percent. Bedrock is at a depth of 20 to 60 inches or more. In areas where the soils formed in compact glacial till, this horizon is hard and brittle and has bulk density of 1.5 to 1.8 grams per cubic centimeter.

Xerochrepts

Xerochrepts are the Ochrepts of Mediterranean climates. They are moist in winter and spring and dry in summer. In this survey area they are at the lower elevations. Most are on terraces at elevations of 2,400 to 2,700 feet. They formed in alluvial, lacustrine, and glacial outwash material. Some of the parent material is calcareous. The vegetation is mountain grassland or an open-grown forest of ponderosa pine with a bunchgrass understory.

Calcixerollic Xerochrepts

Calcixerollic Xerochrepts are the freely drained Xerochrepts that have free carbonates. They formed in sandy, calcareous glacial outwash and alluvium. They share common taxonomic boundaries with Typic Xerochrepts, Typic Eutrochrepts, and Calcic Haploxerolls.

Calcixerollic Xerochrepts, Coarse-Loamy, Mixed, Frigid

Representative Pedon

O—2 inches to 0; duff and litter.
A—0 to 8 inches; light yellowish brown (10YR 6/4) very fine sandy loam; moderate medium platy structure parting to moderate fine subangular blocky; hard, firm, nonsticky and nonplastic; many very fine and fine and common medium and coarse roots; neutral; clear wavy boundary.
Bw—8 to 20 inches; pale brown (10YR 6/3) loamy very fine sand; weak medium subangular blocky structure; soft, friable, nonsticky and nonplastic; many very fine and fine and common medium and coarse roots; slightly effervescent, slightly alkaline; clear wavy boundary.
Bk—20 to 36 inches; light gray (10YR 7/2) very fine sandy loam; massive; very hard, friable, slightly sticky and nonplastic; common very fine and fine roots; lime disseminated throughout, violently effervescent, moderately alkaline; clear wavy boundary.
Ck—36 to 60 inches; pale brown (10YR 6/3) loamy fine sand; single grain; slightly hard, friable, nonsticky and nonplastic; few very fine and fine roots; lime disseminated throughout, violently effervescent, strongly alkaline.

Location and Setting

Northwestern Montana, Lincoln County, Purcell Range, Tooley Lake, SE¼NE¼ sec. 23, T. 37 N., R. 28 W., detailed soil map unit 111. The profile described is on an undulating terrace. The parent material is glacial outwash that has been reworked by wind. Elevation is about 2,600 feet. The vegetation is mountain grassland and open-grown forest.

Range in Characteristics

The A horizon has hue of 7.5YR or 10YR, value of 5 to 7, and chroma of 2 to 4. Texture is very fine sandy loam, fine sandy loam, or loamy very fine sand. Reaction is neutral to moderately alkaline. In some pedons the lower part of the horizon is effervescent. The horizon is 4 to 10 inches thick.

The Bw horizon has hue of 7.5YR or 10YR, value of 5 to 7, and chroma of 2 or 3. Texture is very fine sandy loam, fine sandy loam, loamy very fine sand, or loamy fine sand. The horizon is slightly effervescent or moderately effervescent. It is 8 to 20 inches thick.

The Bk and Ck horizons have hue of 7.5YR or 10YR, value of 5 to 7, and chroma of 2 or 3. Texture is very fine sandy loam, fine sandy loam, loamy very fine sand, or loamy fine sand.

Typic Xerochrepts

Typic Xerochrepts are the freely drained, base-saturated Xerochrepts that do not have free carbonates above a depth of 40 inches. They represent the central concept or typical member of the Xerochrepts great group. They share common taxonomic boundaries with Calcixerollic Xerochrepts, Typic Eutrochrepts, Dystric Eutrochrepts, and Typic Haploxerolls.

Typic Xerochrepts, Fine-Silty, Mixed, Frigid

Representative Pedon

A—0 to 3 inches; dark brown (10YR 3/3) silt loam; weak thin platy structure; soft, friable, slightly sticky and slightly plastic; many fine and very fine and common medium and coarse roots; neutral; clear wavy boundary.

AB—3 to 10 inches; brown (10YR 5/3) silt loam; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine, medium, and coarse roots; neutral; abrupt smooth boundary.

Bw1—10 to 14 inches; light gray (10YR 7/2) silt loam; weak fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few fine, medium, and coarse roots; slightly alkaline; gradual wavy boundary.

Bw2—14 to 37 inches; white (2.5Y 8/0) silt loam; few fine distinct light olive brown (2.5Y 5/4) mottles; moderate coarse subangular blocky structure; hard, firm, slightly sticky and nonplastic; few very fine roots; slightly alkaline; gradual wavy boundary.

BC—37 to 49 inches; light yellowish brown (2.5Y 6/4) silt loam; weak coarse subangular blocky structure; very hard, very firm, slightly sticky and slightly plastic; few medium and fine roots; slightly alkaline; clear and smooth boundary.

C—49 to 60 inches; light gray (2.5Y 7/2) silt; weak fine granular structure; soft, friable, nonsticky and nonplastic; moderately alkaline.

Location and Setting

Northwestern Montana, Lincoln County, Tobacco Valley, NW¼NW¼ sec. 1, T. 36 N., R. 28 W., detailed soil map unit 114. The profile described is on a nearly level terrace. The parent material is lacustrine sediments. The vegetation is open-grown forest. The habitat type is rough fescue/Idaho fescue.

Range in Characteristics

The A horizon has hue of 10YR or 2.5Y and value and chroma of 2 to 4. Texture is loam or silt loam. Reaction is neutral or slightly acid. The horizon is 2 to 6 inches thick.

The Bw horizon has hue of 10YR or 2.5Y or is neutral in hue. It has value of 5 to 8 and chroma of 0 to 4. Texture is loam or silt loam. Reaction is slightly alkaline to slightly acid. The horizon is 15 to 40 inches thick.

The C horizon has hue of 10YR or 2.5Y, value of 5 to 8, and chroma of 1 to 4. It is commonly varved with thin alternating layers of light gray and brown. Texture is silt or silt loam. Reaction is neutral to moderately alkaline. In some pedons the lower part of the horizon is calcareous.

Typic Xerochrepts, Loamy-Skeletal, Mixed, Frigid

Representative Pedon

O—1 inch to 0; grass and twigs.

A—0 to 4 inches; dark grayish brown (10YR 4/2) very gravelly silt loam; weak fine granular structure; soft, friable, slightly sticky and slightly plastic; many fine and very fine, common medium, and few coarse roots; about 45 percent pebbles; neutral; clear wavy boundary.

Bw1—4 to 17 inches; white (10YR 8/1) very gravelly sandy loam; weak fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine and few medium

and coarse roots; about 50 percent pebbles; slightly acid; gradual wavy boundary.

Bw2—17 to 27 inches; light gray (10YR 7/2) very gravelly sandy loam; very weak fine granular structure; soft, very friable, nonsticky and nonplastic; common very fine and fine and few medium roots; about 55 percent pebbles; slightly acid; clear wavy boundary.

C—27 to 60 inches; yellowish brown (10YR 5/6) extremely gravelly loamy sand; single grain; loose, nonsticky and nonplastic; few medium roots; about 75 percent pebbles; slightly acid.

Location and Setting

Northwestern Montana, Lincoln County, Purcell Range, Young Creek, NW¼ sec. 9, T. 36 N., R. 28 W., detailed soil map unit 107. The profile described is on a gently sloping high terrace. The parent material is glacial outwash. Elevation is 2,700 feet. The vegetation is dry, mixed forest. The habitat type is Douglas-fir/snowberry.

Range in Characteristics

The A horizon has hue of 7.5YR or 10YR, value of 3 to 5, and chroma of 2 or 3. Texture is silt loam, loam, or sandy loam. The content of rock fragments ranges from 15 to 60 percent. Reaction is neutral or slightly acid. The horizon is 2 to 5 inches thick.

The Bw horizon has hue of 7.5YR or 10YR, value of 5 to 8, and chroma of 1 to 3. Texture is very fine sandy loam, fine sandy loam, or sandy loam. The content of rock fragments ranges from 35 to 85 percent. Reaction is neutral to moderately acid. The horizon is 20 to 35 inches thick.

The C horizon has hue of 7.5YR or 10YR, value of 5 to 8, and chroma of 3 to 6. Texture is loamy sand or sand. The content of rock fragments ranges from 35 to 85 percent. Reaction is neutral to moderately acid.

Xerolls

Xerolls are base-saturated grassland soils of Mediterranean climates. They have a dark surface layer that is more than 7 inches thick. In 6 years out of 10, they are dry for more than 45 days during the summer.

Calcixerolls

Calcixerolls are Xerolls that have an accumulation of lime in the subsoil within 60 inches of the surface. They are calcareous at or near the surface.

Typic Calcixerolls

Typic Calcixerolls are freely drained, deep Calcixerolls. In this survey area they formed in material derived from calcareous metasedimentary rocks on south-facing mountain slopes. They share common taxonomic boundaries with Calcic Haploxerolls and Typic Haploxerolls.

Typic Calcixerolls, Loamy-Skeletal, Mixed, Frigid

Representative Pedon

O—2 inches to 0; decomposed grass and roots.

A—0 to 13 inches; dark brown (10YR 3/3) gravelly silt loam; moderate medium subangular blocky structure parting to weak fine subangular blocky; slightly hard, firm, slightly sticky and slightly plastic; many very fine, fine, medium, and coarse roots; about 30 percent pebbles; slightly effervescent, slightly alkaline; clear wavy boundary.

Bw1—13 to 22 inches; light yellowish brown (10YR 6/4) very gravelly silt loam; moderate fine subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; many very fine, fine, medium, and coarse roots; about 50 percent pebbles; slightly effervescent, slightly alkaline; clear wavy boundary.

Bw2—22 to 28 inches; light gray (2.5Y 7/2) very gravelly silt loam; moderate fine subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; many very fine, fine, medium, and coarse roots; 55 percent pebbles; strongly effervescent, moderately alkaline; clear wavy boundary.

Bk1—28 to 55 inches; white (5Y 8/2) very gravelly silt loam; moderate medium subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; common very fine, fine, and medium and many coarse roots; about 60 percent pebbles; lime disseminated throughout and lime coatings on the underside of pebbles; violently effervescent, strongly alkaline; abrupt wavy boundary.

Bk2—55 to 60 inches; light gray (5Y 7/2) extremely gravelly silt loam; moderate medium subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; few medium roots; about 70 percent pebbles; lime disseminated throughout and lime coatings on the underside of pebbles; violently effervescent, strongly alkaline.

Location and Setting

Northwestern Montana, Lincoln County, Cabinet Range, Canoe Gulch, sec. 7, T. 30 N., R. 20 W., detailed soil map unit 510. The profile described is on a south-facing mountain slope. Slope is 30 percent. The parent material is derived from calcareous metasedimentary rocks. Elevation is 3,000 feet. The vegetation is open-grown forest. The habitat type is ponderosa pine/bitterbrush.

Range in Characteristics

The A horizon has hue of 10YR or 2.5Y, value of 2 or 3, and chroma of 1 to 3. Texture is silt loam or loam. The content of rock fragments ranges from 5 to 35 percent. The horizon is 7 to 20 inches thick.

The Bw horizon has hue of 10YR or 2.5Y, value of 4 to 7, and chroma of 2 to 4. Texture is silt loam, loam, or fine sandy loam. The content of rock fragments ranges from 35 to 60 percent. Reaction is slightly alkaline or moderately alkaline. The horizon is slightly effervescent or moderately effervescent. It is 10 to 25 inches thick.

The Bk horizon has hue of 10YR to 5Y, value of 6 to 8, and chroma of 1 to 3. Texture is silt loam, loam, or fine sandy loam. The content of rock fragments ranges from 35 to 85 percent. Reaction is moderately alkaline or strongly alkaline.

Formation of the Soils

Five principal factors affect soil formation. They are parent material, topography, biological activity, climate, and time. These soil-forming factors are interdependent; each modifies the effects of the others.

Soil is formed through the combined effects of these five factors. The differences in soils are mainly due to the relative importance or strength of the various factors. In mountainous areas changes in one or more soil-forming factors occur within relatively short distances. The many microclimates that result from change in elevation, air drainage, topography, slope, and aspect strongly influence soil formation. Topography, time, and the complexity of the parent material also influence the kinds of soil that form in the area. The relative effects of each soil-forming factor in determining soil characteristics at any particular site are difficult to evaluate.

Some relationships between soil properties and parent material are obvious in the survey area. Most of the soils have a surface layer of loess that has been influenced by volcanic ash. Most of the volcanic ash is from the eruption of Mt. Mazama (Crater Lake, Oregon) in the year 6800 B.C. Volcanic ash from other sources, such as Glacier Peak and several eruptions of Mt. St. Helens, also has been identified in the area.

The depth of the loess surface layer is partially correlated with landscape position. The loess surface layer tends to be thicker on north-facing slopes and on concave slopes than on other slopes. It is undetectable on some steep, south-facing slopes. The loess is often diluted on some ridges and the steeper slopes because it has been mixed with subsoil material. It generally is dark brown to reddish brown.

The parent material of the subsoil and substratum is derived from the underlying rocks, glacial drift, or lacustrine deposits. The subsoil and substratum of the soils formed in these kinds of parent material are dominantly medium textured to coarse textured. Those formed in weathered glacial till or lacustrine deposits can be moderately fine textured or fine textured. Some of the parent material of the subsoil and substratum is calcareous, and the soils that formed in this parent material can have free lime in the subsoil or substratum. If formed in compact glacial till, the substratum has bulk density of 1.5 to 1.8 grams per cubic centimeters when dry and is hard and brittle when moist.

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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.

Albic horizon. A light colored surface layer or lower horizon from which clay and free iron oxides have been removed or so segregated as to permit the color to be determined by the primary sand particles.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Alpine. Characteristic of high mountains, especially ones modified by intense glacial erosion. Implies high elevation and cold climate.

Aquic moisture regime. A reducing regime that is virtually free of dissolved oxygen because the soil is saturated by ground water.

Argillic horizon. A subsoil horizon characterized by an accumulation of illuvial clay.

Argillite. A compact rock derived from mudstone or shale composed primarily of clay-sized particles.

Arterial road. A forest road that services large areas of land and usually connects with public highways. It is designed for maximum mobility and travel efficiency.

Ash, volcanic. Fine pyroclastic material smaller than 4.0 millimeters in diameter. In this survey area the volcanic ash qualifies as fine ash, less than 0.25 millimeter in diameter, because it is mostly in the size ranges of silt and very fine sand.

Base saturation. The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation-exchange capacity.

Basin. A depressional area that has no outlet or limited outlets.

Bedrock. The solid material that underlies the soil and other unconsolidated material or that is exposed at the surface.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Breaklands. The steep or very steep broken land at the border of an upland that is dissected by ravines or canyons.

Bulk density. The mass of dry soil per unit volume, expressed in grams per cubic centimeter.

Cable yarding. A method of moving felled trees to a nearby central area for transport to a processing facility. Most cable yarding systems involve use of a drum, a pole, and wire cables in an arrangement similar to that of a rod and reel used for fishing. To reduce friction and soil disturbance, felled trees generally are reeled in while one end is lifted or the entire log is suspended.

Cambic horizon. A horizon that has been altered or changed by soil-forming processes, generally occurring below a diagnostic surface horizon.

Canopy. The leafy crown of trees or shrubs. (See Crown.)

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity but is more precise in meaning.

Channel. The bed of a single or braided watercourse that commonly is devoid of vegetation and is formed of modern alluvium.

Cirque. A semicircular, concave, bowllike area that has steep faces primarily resulting from glacial ice and snow abrasion.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Climax vegetation. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse fragments. Mineral or rock particles larger than 2 millimeters in diameter.

Coarse textured soil. Sand or loamy sand.

Cobble. A rounded or partly rounded fragment of rock 3 to 10 inches (7.6 to 25.0 centimeters) in diameter.

Cobbly soil material. Material that is 15 to 35 percent, by volume, rounded or partially rounded rock fragments 3 to 10 inches (7.6 to 25.0 centimeters) in diameter. Very cobbly soil material is 35 to 60 percent of these rock fragments, and extremely cobbly soil material is more than 60 percent.

Collector road. A forest road that connects to an arterial road and serves a smaller area of land. The design of the road is influenced by the transportation needs of the land it serves.

Colluvium. Soil material or rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

Compaction. The packing together of soil particles by forces exerted at the surface, resulting in increased solid density.

Complex slope. Irregular or variable slope.

Complex, soil. A map unit of two or more kinds of soil or miscellaneous areas in such an intricate pattern or so small an area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas.

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 at various soil moisture contents are:

Wet soil.—Nonsticky, slightly sticky, sticky, very sticky, nonplastic, slightly plastic, plastic, very plastic.

Moist soil.—Loose, very friable, friable, firm, very firm, extremely firm.

Dry soil.—Loose, soft, slightly hard, hard, very hard, extremely hard.

Creep. Slow mass movement of earth material down relatively steep slopes, primarily under the influence of gravity but facilitated by water saturation and frost action.

Crown. The upper part of a tree or shrub, including the living branches and their foliage.

Cryic. A soil temperature regime in which the mean annual soil temperature at a depth of 20 inches is higher than 0 degrees C but lower than 8 degrees C and the mean summer soil temperature is lower than 8 degrees C if an O horizon is present.

Cutbanks, road. The steep slope above a road from which material has been excavated during construction.

Delineation. A single enclosed area within a drawn boundary line on a map. A single occurrence of a map unit.

Dendritic drainage system. A drainage pattern characterized by a treelike branching system in which the tributaries join the main stream from all directions and at almost any angle.

Deposition. The laying down of potential rock-forming materials; sedimentation.

Deranged. A poorly integrated drainage system resulting from a relatively young landform having a flat or undulating topographic surface. Deranged drainage patterns are on moraines in this survey area.

Displacement. Repositioning or removal of the surface soil layer by mechanical action.

Dissected slope. A slope with deeply cut drainageways at frequent intervals. The drainageways are generally low order and are on valley side slopes that have narrow spur ridges.

Drainage pattern. The spatial relationships among streams or rivers, including geographic orientation and angles of intersection of streams. These are influenced by topographic relief, parent material, and soil material.

Draw. A small stream valley that generally is more open and has broader bottom land than a ravine or gulch.

Droughty. An area or soil that characteristically has either a prolonged or chronic lack of available water.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Erodibility. The tendency of a soil to be eroded.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion hazard. An interpretation of the risk of erosion associated with a specified management practice.

Fan, alluvial. A low, outspread, gently sloping mass of loose rock material shaped like an open fan or a segment of a cone, deposited by a stream.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in the

proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fill, road. A structure, often composed largely of borrowed soil and rock materials, that forms the foundation upon which a road surface is constructed.

Fill slope. A sloping surface consisting of excavated soil material from a road cut. It is commonly is on the downhill side of a road.

Fine textured soil. Sandy clay, silty clay, or clay.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially. It is usually a landform built of sediments deposited during overflow and lateral migration of the stream.

Forb. Any herbaceous plant not a grass or a sedge.

Forest cover. All trees and other woody plants (underbrush) covering the ground in a forest.

Frigid. A soil temperature regime in which the soil at a depth of 20 inches has a mean soil temperature of 0 degrees C to 8 degrees C and a mean summer soil temperature equal to or greater than 8 degrees C.

Frost pocket. Accumulation of cold air in a topographic low or depression leading to the unseasonal occurrence of frost.

Glacial. Of or relating to the presence and activities of ice and glaciers, as glacial erosion. Pertaining to distinctive features and materials produced by or derived from glaciers and ice sheets, as glacial lakes. Pertaining to an ice age or region of glaciation.

Glacial till. Unsorted, nonstratified glacial drift, generally unconsolidated, deposited directly by a glacier without subsequent reworking by water from the glacier, and consisting of a heterogeneous mixture of clay, sand, gravel, and boulders varying widely in size and shape.

Glaciation. The formation, movement, and recession of glaciers or ice sheets. A collective term for the geologic processes of glacial activity, including erosion and deposition, and the resulting effects of such action on the earth's surface.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors.

Granite. A plutonic rock in which quartz constitutes 10 to 50 percent of the felsic components and in which alkali feldspar constitutes 65 to 90 percent of total feldspar.

Granitic. A class of igneous rocks in which the constituent crystals are visible to the unaided eye. Because of crowding, the crystals are nonglassy in appearance and approximately of the same size.

Gravel. Rounded or angular fragments of rock as much as 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, as much as 3 inches (7.6 centimeters) in diameter.

Ground water. Water filling all the unblocked pores of the material below the water table.

Habitat type. All land areas potentially capable of producing similar plant communities at climax. Habitat types are named by the climax tree species in the first part of the name and a dominant undergrowth species in the second part of the name.

Headwall. The steep slope at the head of a valley; especially the rock cliff at the back of a cirque.

Herbage. The total production of grasses, forbs, and shrubs available to livestock.

Hill. A natural elevation of the land surface, rising as much as 1,000 feet above surrounding lowlands, commonly of limited summit area and having a well defined outline.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. The major horizons of mineral soil are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying soil material. The material of a C horizon may be either like or

unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

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.

Hummock. A rounded or conical mound or knoll, hillock, or other small elevation. Also, a slight rise of ground above a level surface.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Inclusion. Soil found within a map unit not extensive enough to be mapped separately or as part of a complex.

Intrusive. Denoting igneous rocks derived from molten matter (magmas) that invaded pre-existing rocks and cooled below the surface of the earth.

Isohyet. A line connecting points of equal precipitation.

Lacustrine deposit. Clastic sediments deposited in a lake.

Landform. Any physical, recognizable form or feature of the earth's surface, having a characteristic shape and produced by natural causes. The landforms in this survey area are described under the heading "Physiography."

Landscape. All the natural features, such as fields, hills, forests, and water, that distinguish one part of the earth's surface from another part. Also, the distinct association of landforms, especially as modified by geologic forces, that can be seen in a single view.

Landslide. A mass-wasting process, and the landform produced, involving moderately rapid or rapid (greater than 1 foot per year) downslope transport, by means of gravitational stresses, of a mass of rock and regolith that may or may not be water saturated.

Landtype. Unit of land with similar designated soil, vegetation, geology, topography, climate, and drainage.

Leaching. The removal of soluble material from soil or other material by percolating water.

Limestone. A sedimentary rock consisting chiefly (more than 50 percent) of calcium carbonate, primarily in the form of calcite.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Lithologic. Pertaining to the physical characteristics of a rock.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Local road. A forest road that connects terminal facilities to collector and arterial roads or public highways. It is designed according to the specific project transportation need. It is generally closed to use when the project is complete.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low bearing strength. The soil is not strong enough to support loads.

Map unit. The set of areas delineated on a map considered similar to all other members of the set (delineations) with respect to the selected properties used to define the set.

Mean annual increment. The annual increase per acre in the volume of a stand. Computed by dividing the total volume of a stand by the age of the stand.

Meander. One of a series of sinuous loops, with sine-wave form, in the course of a stream channel. Meandering streams commonly have cross sections with low width to depth ratios; fine grained, cohesive bank material; and low gradient.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Metasedimentary rocks. Sedimentary rocks that show evidence of having been subjected to metamorphism.

Micaceous rocks. Rocks that weather to produce material containing 40 percent or more mica.

Middle Proterozoic. Era of geologic time (approximately 900 to 1,600 million years ago).

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, or fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, or silty clay loam.

Moraine. An accumulation of earth, stones, and other debris deposited by a glacier.

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. Descriptive terms are as follows: abundance—*few, common,* and *many;* size—*fine, medium,* and *coarse;* and contrast—

faint, distinct, and *prominent.* The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium,* from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse,* more than 15 millimeters (about 0.6 inch).

Mountain. A natural elevation of the land surface, rising more than 1,000 feet above surrounding lowlands, commonly of restricted summit area (relative to a plateau) and generally having steep sides. A mountain can occur as a single, isolated mass or in a group forming a chain or range.

Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with hue of 10YR, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 to 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Outcrop. That part of a geologic formation or structure that appears at the surface of the earth.

Outsloping. A road drainage practice in which the road surface is sloped away from the cut slope and drainage water is discharged on the fill slope.

Parallel drainage system. In this survey area, a local drainage pattern in which tributaries are parallel to one another and join the main stream at right angles, characteristic of steeply sloping landforms and high energy streams.

Parent material. The unconsolidated organic and mineral matter in which soil forms.

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.

Permeability. The quality of the soil that enables water or air to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Pleistocene. The first epoch of the Quaternary period of geologic time, following the Tertiary Pliocene epoch and preceding the Holocene epoch (about 2 million to 10,000 years ago).

Pre-Cambrian. First era of geologic time (approximately 570 million years or more ago.)

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. The vertical section of the soil extending through all its horizons and into the parent material.

Puddling. Destruction of the natural soil structure by agitation with water.

Pyroxenite. An ultramafic plutonic rock chiefly composed of pyroxene.

Quartzite. Relatively hard rock derived from metamorphosed sandstone.

Quaternary. The second period of the Cenozoic era of geologic time, extending from the end of the Tertiary period (about 2 million years age) to the present and comprising two epochs, the Pleistocene (ice age) and Holocene (recent).

Rangeland. Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Ravel. The movement of individual soil or gravel particles down a slope by gravitational force.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are:

Ultra acid	less than 3.5
Extremely acid	3.5 to 4.4
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

Regeneration. The renewal of a tree crop by natural or artificial means.

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock.

Relief. The elevations or inequalities of a land surface, considered collectively.

Resident. Term describing fish species in the survey area that spend their entire life cycle in local stream systems.

Residuum (residual soil material). Unconsolidated, weathered or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Ridge. A long, narrow elevation of the land surface, usually sharp crested with steep sides and forming an extended upland between valleys.

Rippable. Material, usually bedrock, which can be mechanically dislodged using machines without resorting to the use of explosives.

Road cut. The sloping surface produced by mechanical means during road construction. It is commonly on the uphill side of the road.

Rock fall. Fall of cobble-sized and larger rocks from steep cut slopes onto the road surface.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rock outcrop. Barren exposures of hard bedrock that is fractured in places. Some soil material is in cracks and crevices. The rock is mostly metasedimentary in this survey area. When rock outcrop is on steep slopes, it generally includes small areas of loose stones, cobbles, or gravel.

Rock weathering. Transformation of rock by physical and chemical processes associated with the environment at the earth's surface.

Rolling grade. A road drainage practice in which the road grade is designed to provide low points at intervals to allow drainage water to escape.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of an area without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Ruts. Furrows made in road surfaces by the passage of wheeled vehicles over wet, plastic soil material.

Sand. 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.

Scour. The powerful and concentrated clearing and digging action of flowing air, water, or ice.

Sediment. Solid clastic material, both mineral and organic, that is in suspension, is being transported, or has been moved from its site of origin by water, wind, ice, or mass-wasting and has come to rest on the earth's surface either above or below sea level.

Sediment delivery efficiency. The relative ease with which sediments produced in a landscape reach stream channels within the same landscape. This is the qualitative equivalent of the sediment delivery ratio, which is the ratio of the sediment reaching streams to the amount eroded within a drainage area.

Seral. A plant species or community that is replaced by another species or community as succession progresses.

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.

Siltite. An indurated or somewhat indurated rock composed primarily of silt-sized particles.

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.

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.

Slough. Small landslides involving less than 10 cubic yards of material that detaches from the slopes of road cuts and falls in the road ditches and on the road surface.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25

Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solar insolation. Sum total of all long and short wave radiation intercepted by a slope.

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the material below the solum. The living roots and plant and animal activities are largely confined to the solum.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter if rounded or 15 to 24 inches (38 to 60 centimeters) in length if flat.

Stratified. Formed, arranged, or laid down in layers. The term refers to geologic deposits. Layers in soils that result from the processes of soil formation are called horizons; those inherited from the parent material are called strata.

Stream order. In a drainage basin network, the smallest unbranched tributaries are designated stream order 1; the confluence of two first-order streams produces a stream segment of order 2; the junction of two second-order streams produces a stream segment of order 3; etc. The order of a drainage basin is determined by the highest integer.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular. Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Subgrade. The upper part of roadfill upon which the road surfacing components are placed.

Subsoil. Technically, the B horizon; roughly, the part of the solum below the surface soil.

Substratum. The part of the soil below the solum.

Surface layer. The uppermost layer in the soil, usually ranging in depth from 4 to 10 inches.

Taxonomic unit. A defined class at any categorical level in the soil classification system. The soil names for map units refer to taxonomic units.

Terrace, stream. A steplike surface, bordering a valley floor or shoreline, that represents the former position of an alluvial plain, fan, lake, or seashore. The term is usually applied to both the relatively flat summit surface (platform, tread), cut or built by stream or wave action, and the steeper descending slope (scarp, riser), graded to a lower base level of erosion.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay.* The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Topography. The relative position and elevations of the natural or constructed features of an area that describe the configuration of its surface.

Transitory range. Livestock forage available from typically forested land during the period of seral grass, forb, and shrub growth following timber harvest or fire.

Trough wall. The side slope of an elongated, U-shaped valley produced by glacial activity.

Udic. A soil that, in the moisture-control section of the soil profile, is not dry (less than 15-bar soil water) in any part for as long as 90 days (cumulative) in most years and is not dry in all parts for as long as 45 consecutive days in the 4 months that follow the summer solstice in 6 or more years out of 10.

Upland. The elevated land above the low areas along streams or between hills; land above the footslope zone of the hillslope continuance.

Ustic. A soil which, in the moisture-control section of the soil profile, is dry (less than 15-bar soil water) in some or all parts for 90 days or more (cumulative) in most years but is not dry more than half the time that the soil temperature is above 50 degrees C at a depth of 50 centimeters. This moisture regime is intended to recognize soils that are dry most of the time; however, moisture is available to plants during the growing season.

Valley. An elongated, relatively large, externally drained depression of the earth's surface that is primarily developed by stream erosion.

Volcanic. Pertaining to the deep-seated (igneous) processes by which magma and associated gases rise through the crust and are extruded onto the earth's surface and into the atmosphere and the structure, rocks, and landforms produced.

Water bar. A shallow ditch excavated diagonally across a road surface to provide cross drainage.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the

earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Windthrow. The uprooting and tipping over of trees by the wind.

Xeric. The soil moisture regime in which the soil moisture-control section is dry in all parts for 45 or more consecutive days during 4 months in the summer and moist for 45 or more consecutive days during 4 months in the winter.

Tables

TABLE 1.--AVERAGE ANNUAL PRECIPITATION AND TEMPERATURE

(Recorded in the period 1951-80)

Weather station	Elevation	Average annual precipitation	Average annual temperature
	Ft	In	°F
Troy	1,929	25.5	46.3
Libby (1 mile northeast)	2,080	19.4	45.1
Heron (2 miles northwest)	2,240	34.3	44.0
Rexford Ranger Station*	2,350	17.3	44.3
Trout Creek Ranger Station	2,356	29.1	45.6
Eureka Ranger Station**	2,532	13.8	44.7
Troy (18 miles north)	2,716	36.5	44.4
Fortine (1 mile north)	3,000	17.0	41.6
Libby (32 miles south-southeast)	3,600	26.6	40.7

* Records end in 1960.
** Records begin in 1960.

TABLE 2.--FEATURES USED TO PLOT BOUNDARIES OF MAP UNITS

Map symbol	Landform	Slope	Parent material	Vegetation	Aspect	Elevation	Rock outcrop
		Pct				Ft	Pct
101	Flood plains	0-10	Alluvial deposits	Moist, mixed forest	Variable	1,800-4,200	0
102	Terraces	0-15	Lacustrine deposits	Moist, mixed forest	Variable	2,000-3,700	0
103	Terraces	0-15	Alluvial deposits	Moist, mixed forest	Variable	2,000-3,500	0
104	Kames and kettles	5-35	Glacial drift	Moist, mixed forest	Variable	2,500-4,000	0
105	Alluvial basins	0-5	Alluvial deposits	Wet meadows	Variable	2,000-4,000	0
106	Terraces	0-15	Glacial outwash deposits	Moist, mixed forest	Variable	2,500-4,000	0
107	Terraces	0-15	Glacial outwash deposits	Mountain grassland	Variable	2,500-2,700	0
108	Terraces	0-15	Lacustrine deposits and glacial outwash deposits.	Moist, mixed forest	Variable	2,000-4,000	0
109	Terraces	0-15	Alluvial deposits	Mountain grassland	Variable	2,500-2,700	0
110	Terraces	0-15	Glacial outwash deposits	Moist, mixed forest	Variable	2,000-3,500	0
111	Terraces	0-15	Glacial outwash deposits	Mountain grassland	Variable	2,500-2,700	0
112	Terraces	0-25	Lacustrine deposits	Moist, mixed forest	Variable	2,200-3,600	0
114	Terraces	0-15	Lacustrine deposits	Mountain grassland	Variable	2,500-2,700	0
201	Breaklands	60-80	Material weathered from metasedimentary rocks.	Dry, mixed forest	Southerly	2,400-4,800	50
251	Breaklands	60-80	Material weathered from metasedimentary rocks.	Dry, mixed forest and moist, mixed forest.	Northerly	2,500-5,000	40
252	Breaklands	60-80	Material weathered from metasedimentary rocks.	Moist, mixed forest	Northerly	3,100-5,000	0
301	Glaciated mountain slopes.	15-35	Compact glacial till	Dry, mixed forest	Southerly	2,400-3,800	0
302	Glaciated mountain slopes.	30-60	Compact glacial till	Dry, mixed forest	Southerly	3,000-4,200	0
303	Glaciated mountain ridges.	15-35	Material weathered from metasedimentary rocks.	Open-grown forest	Southerly	3,500-4,700	50
321	Drumlins and moraines.	10-40	Compact glacial till	Dry, mixed forest	Variable	2,500-3,800	0

TABLE 2.--FEATURES USED TO PLOT BOUNDARIES OF MAP UNITS--Continued

Map symbol	Landform	Slope	Parent material	Vegetation	Aspect	Elevation	Rock outcrop
		Pct				Ft	Pct
322	Moraines	15-35	Compact glacial till	Moist, mixed forest	Variable	2,500-5,000	0
323	Moraines	15-35	Compact glacial till	Dry, mixed forest	Variable	2,500-5,000	0
324	Moraines	15-35	Compact glacial till	Dry, mixed forest	Variable	2,500-4,000	0
325	Flood plains and alluvial fans.	5-25	Alluvial deposits	Moist, mixed forest	Variable	2,500-4,500	0
328	Glaciated mountain slopes.	15-35	Compact glacial till	Moist, mixed forest	Northerly	3,000-5,400	0
329	Moraines	15-35	Compact glacial till	Subalpine forest	Variable	3,000-5,500	0
351	Dissected glaciated mountain slopes.	30-60	Compact glacial till	Moist, mixed forest	Northerly	3,000-4,500	0
352	Glaciated mountain slopes.	20-60	Compact glacial till	Moist, mixed forest	Northerly	2,200-5,600	0
353	Glaciated mountain ridges.	15-35	Material weathered from metasedimentary rocks.	Subalpine forest and moist, mixed forest.	Variable	4,000-6,000	30
355	Glaciated mountain slopes.	20-50	Compact glacial till	Moist, mixed forest	Northerly	3,000-5,500	20
357	Dissected glaciated mountain slopes.	30-60	Compact glacial till and material weathered from metasedimentary rocks.	Moist, mixed forest	Northerly	3,500-5,500	0
360	Glaciated mountain ridges.	15-35	Material weathered from metasedimentary rocks.	Subalpine forest	Variable	4,500-6,000	60
365	Dissected glaciated mountain slopes.	60-80	Compact glacial till	Moist, mixed forest	Northerly	2,500-5,500	0
370	Glaciated mountain slopes.	15-35	Material weathered from granitic rocks.	Moist, mixed forest	Variable	3,800-6,000	0
381	Dissected glaciated mountain slopes.	30-60	Compact glacial till and material weathered from metasedimentary rocks.	Dry, mixed forest	Southerly	3,000-5,000	0
401	Glacial trough walls	60-80	Material weathered from metasedimentary rocks and friable glacial till.	Subalpine forest	Variable	4,200-8,000	40

TABLE 2.--FEATURES USED TO PLOT BOUNDARIES OF MAP UNITS--Continued

Map symbol	Landform	Slope	Parent material	Vegetation	Aspect	Elevation	Rock outcrop
		Pct				Ft	Pct
403----	Cirque headwalls and alpine ridges.	40-80	Material weathered from metasedimentary rocks and friable glacial till.	Subalpine forest-------	Variable	5,500-8,700	60
404----	Moraines----------	15-45	Friable glacial till------	Moist, mixed forest----	Variable	4,500-6,500	0
405----	Glaciated mountain ridges.	15-50	Material weathered from metasedimentary rocks and friable glacial till.	Subalpine forest-------	Variable	5,500-8,000	20
406----	Glaciated mountain ridges.	15-50	Material weathered from metasedimentary rocks and friable glacial till.	Subalpine forest-------	Variable	5,000-6,500	0
407----	Moraines----------	5-20	Friable glacial till------	Moist, mixed forest----	Variable	3,000-5,500	0
408----	Glaciated mountain slopes.	60-80	Material weathered from metasedimentary rocks and friable glacial till.	Moist, mixed forest----	Variable	3,000-5,500	15
502----	Mountain slopes------	35-60	Material weathered from metasedimentary rocks.	Dry, mixed forest------	Southerly	2,800-4,500	0
503----	Mountain slopes------	35-55	Material weathered from metasedimentary rocks.	Open-grown forest------	Southerly	3,000-5,000	50
510----	Mountain slopes------	15-50	Material weathered from metasedimentary rocks.	Open-grown forest------	Southerly	3,000-4,500	0
520----	Mountain slopes------	15-35	Material weathered from micaceous rocks.	Moist, mixed forest----	Variable	2,700-4,000	0
522----	Mountain slopes------	20-60	Material weathered from granitic rocks.	Moist, mixed forest----	Variable	3,000-5,500	0
552----	Mountain slopes------	35-60	Material weathered from metasedimentary rocks.	Moist, mixed forest----	Northerly	3,000-5,400	0
555----	Mountain slopes------	25-50	Material weathered from metasedimentary rocks.	Moist, mixed forest----	Variable	3,500-6,000	20
570----	Mountain slopes------	35-60	Material weathered from metasedimentary rocks.	Moist, mixed forest and dry, mixed forest.	Variable	2,500-5,000	0

TABLE 3.--NUMERICAL LISTING OF MAP SYMBOLS AND THE ACREAGE OF THE SOILS

Map symbol	Soil name	Acres
101	Fluvents, flood plains	27,851
102	Andic Dystric Eutrochrepts, lacustrine terraces	59,284
103	Andic Dystrochrepts, alluvial terraces	48,680
104	Andic Dystrochrepts-Umbric Vitrandepts complex, kames and kettles	24,087
105	Aquic Udifluvents, poorly drained	11,917
106	Andic Dystrochrepts, glacial outwash terraces	51,828
107	Typic Xerochrepts, glacial outwash terraces	8,046
108	Andic Dystric Eutrochrepts, lacustrine terraces-Andic Dystrochrepts, glacial outwash terraces, complex	73,318
109	Typic Xerochrepts, alluvial terraces	4,105
110	Eutrochrepts, glacial outwash terraces	10,218
111	Calcixerollic Xerochrepts, glacial outwash terraces	6,294
112	Eutric Glossoboralfs, lacustrine terraces	31,042
114	Typic Xerochrepts, lacustrine terraces	2,102
201	Rock outcrop-Lithic Ustochrepts-Typic Ustochrepts complex, breaklands	48,122
251	Andic Dystrochrepts-Rock outcrop complex, breaklands	39,543
252	Andic Dystrochrepts, breaklands	74,176
301	Dystric Eutrochrepts, glaciated mountain slopes	19,512
302	Typic Ustochrepts, glaciated mountain slopes, steep	44,263
303	Rock outcrop-Lithic Ustochrepts complex, glaciated mountain ridges	32,912
321	Typic Eutroboralfs, drumlins	32,248
322	Eutric Glossoboralfs, moraines	79,632
323	Typic Eutroboralfs, moraines	88,350
324	Typic Eutrochrepts, moraines	92,184
325	Aeric Calciaquolls, somewhat poorly drained	7,423
328	Andic Cryochrepts, glaciated mountain slopes	51,587
329	Andic Cryochrepts, moraines, dense, brittle substratum	67,741
351	Andic Dystrochrepts, dissected glaciated mountain slopes	14,361
352	Andic Dystrochrepts, glaciated mountain slopes	496,683
353	Andic Cryochrepts-Rock outcrop-Lithic Cryochrepts complex, glaciated mountain ridges	66,419
355	Andic Dystrochrepts-Rock outcrop complex, glaciated mountain slopes	462,918
357	Andic Cryochrepts-Lithic Cryochrepts complex, dissected glaciated mountain slopes	48,575
360	Rock outcrop-Lithic Cryochrepts complex, glaciated mountain ridges	30,754
365	Andic Dystrochrepts, dissected glaciated mountain slopes, steep	6,299
370	Andic Dystrochrepts, glaciated mountain slopes, granitic substratum	5,456
381	Typic Ustochrepts-Lithic Ustochrepts complex, dissected glaciated mountain slopes, dry	7,193
401	Rock outcrop-Andic Cryochrepts-Lithic Cryochrepts complex, glacial trough walls	91,982
403	Rock outcrop-Lithic Cryochrepts-Andic Cryochrepts complex, cirque headwalls and alpine ridges	65,211
404	Andic Cryochrepts, moraines, steep	53,857
405	Lithic Cryochrepts-Andic Cryochrepts-Rock outcrop complex, glaciated mountain ridges	89,043
406	Andic Cryochrepts, glaciated mountain ridges	95,820
407	Andic Cryochrepts, moraines	48,285
408	Andic Cryochrepts-Rock outcrop complex, glaciated mountain slopes, very steep	62,764
502	Typic Ustochrepts, mountain slopes, south aspects	13,241
503	Rock outcrop-Lithic Ustochrepts complex, south aspects	12,412
510	Typic Calcixerolls, south aspects	29,948
520	Andic Dystric Eutrochrepts, micaceous substratum	2,878
522	Andic Dystrochrepts, granitic substratum	13,491

TABLE 3.--NUMERICAL LISTING OF MAP SYMBOLS AND THE ACREAGE OF THE SOILS--Continued

Map symbol	Soil name	Acres
552	Andic Dystrochrepts, mountain slopes	67,892
555	Andic Cryochrepts-Rock outcrop complex, mountain slopes	101,334
570	Andic Dystrochrepts-Typic Ustochrepts complex, mountain slopes	7,712
	Water	44,604
	Total	2,975,597

TABLE 4.--ALPHABETICAL LISTING OF DETAILED SOIL MAP UNITS

Map symbol	Soil name
325	Aeric Calciaquolls, somewhat poorly drained
406	Andic Cryochrepts, glaciated mountain ridges
328	Andic Cryochrepts, glaciated mountain slopes
357	Andic Cryochrepts-Lithic Cryochrepts complex, dissected glaciated mountain slopes
407	Andic Cryochrepts, moraines
329	Andic Cryochrepts, moraines, dense, brittle substratum
404	Andic Cryochrepts, moraines, steep
408	Andic Cryochrepts-Rock outcrop complex, glaciated mountain slopes, very steep
555	Andic Cryochrepts-Rock outcrop complex, mountain slopes
353	Andic Cryochrepts-Rock outcrop-Lithic Cryochrepts complex, glaciated mountain ridges
102	Andic Dystric Eutrochrepts, lacustrine terraces
108	Andic Dystric Eutrochrepts, lacustrine terraces-Andic Dystrochrepts, glacial outwash terraces, complex
520	Andic Dystric Eutrochrepts, micaceous substratum
103	Andic Dystrochrepts, alluvial terraces
252	Andic Dystrochrepts, breaklands
351	Andic Dystrochrepts, dissected glaciated mountain slopes
365	Andic Dystrochrepts, dissected glaciated mountain slopes, steep
106	Andic Dystrochrepts, glacial outwash terraces
352	Andic Dystrochrepts, glaciated mountain slopes
370	Andic Dystrochrepts, glaciated mountain slopes, granitic substratum
522	Andic Dystrochrepts, granitic substratum
552	Andic Dystrochrepts, mountain slopes
251	Andic Dystrochrepts-Rock outcrop complex, breaklands
355	Andic Dystrochrepts-Rock outcrop complex, glaciated mountain slopes
570	Andic Dystrochrepts-Typic Ustochrepts complex, mountain slopes
104	Andic Dystrochrepts-Umbric Vitrandepts complex, kames and kettles
105	Aquic Udifluvents, poorly drained
111	Calcixerollic Xerochrepts, glacial outwash terraces
301	Dystric Eutrochrepts, glaciated mountain slopes
112	Eutric Glossoboralfs, lacustrine terraces
322	Eutric Glossoboralfs, moraines
110	Eutrochrepts, glacial outwash terraces
101	Fluvents, flood plains
405	Lithic Cryochrepts-Andic Cryochrepts-Rock outcrop complex, glaciated mountain ridges
401	Rock outcrop-Andic Cryochrepts-Lithic Cryochrepts complex, glacial trough walls
403	Rock outcrop-Lithic Cryochrepts-Andic Cryochrepts complex, cirque headwalls and alpine ridges
360	Rock outcrop-Lithic Cryochrepts complex, glaciated mountain ridges
303	Rock outcrop-Lithic Ustochrepts complex, glaciated mountain ridges
503	Rock outcrop-Lithic Ustochrepts complex, south aspects
201	Rock outcrop-Lithic Ustochrepts-Typic Ustochrepts complex, breaklands
510	Typic Calcixerolls, south aspects
321	Typic Eutroboralfs, drumlins
323	Typic Eutroboralfs, moraines
324	Typic Eutrochrepts, moraines
302	Typic Ustochrepts, glaciated mountain slopes, steep
381	Typic Ustochrepts-Lithic Ustochrepts complex, dissected glaciated mountain slopes, dry
502	Typic Ustochrepts, mountain slopes, south aspects
109	Typic Xerochrepts, alluvial terraces
107	Typic Xerochrepts, glacial outwash terraces
114	Typic Xerochrepts, lacustrine terraces

TABLE 5.--TIMBER MANAGEMENT AND PRODUCTIVITY

(Only map units with a forested component are listed)

Map symbol	Tractor operation	Regeneration	Sediment hazard	Non-forested area	Forest vegetative group	Relative productivity
				Pct		
101	Soil damage	Frost pockets	Severe	20	Moist, mixed forest	High.
102	Soil damage	No limitations	Moderate	0	Moist, mixed forest	High.
					Dry, mixed forest	Moderate.
103	Soil damage	No limitations	Severe	0	Moist, mixed forest	High.
104	Soil damage	Frost pockets	Moderate	15	Moist, mixed forest	High.
106	Soil damage	No limitations	Moderate	0	Moist, mixed forest	High.
108	Soil damage	No limitations	Moderate	0	Moist, mixed forest	High.
110	Soil damage	No limitations	Moderate	0	Moist, mixed forest	High.
112	Soil damage	No limitations	Moderate	0	Moist, mixed forest	High.
251	Slope, rock outcrop.	No limitations	Severe	40	Moist, mixed forest	High.
					Dry, mixed forest	Low
252	Slope	No limitations	Severe	0	Moist, mixed forest	High.
301	No limitations	No limitations	Moderate	0	Dry, mixed forest	Moderate.
302	Slope	No limitations	Moderate	0	Dry, mixed forest	Moderate.
303	Rock outcrop	No limitations	Moderate	50	Open-grown forest	Very low.
321	No limitations	Competition	Moderate	0	Dry, mixed forest	Moderate.
322	Soil damage	No limitations	Moderate	0	Moist, mixed forest	High.
323	No limitations	Competition	Moderate	0	Dry, mixed forest	Moderate.
324	No limitations	Competition	Moderate	0	Dry, mixed forest	Moderate.
325	Soil damage	Frost pockets	Severe	0	Moist, mixed forest	High.
328	Soil damage	No limitations	Moderate	0	Moist, mixed forest	High.
329	Soil damage	No limitations	Moderate	0	Subalpine forest	High.
351	Slope	No limitations	Severe	0	Moist, mixed forest	High.
352	Complex slope, soil damage.	No limitations	Moderate	0	Moist, mixed forest	High.
353	Soil damage, rock outcrop.	Harsh climate at higher elevations.	Moderate	30	Subalpine forest	Very low.
					Moist, mixed forest	High.
355	Rock outcrop	No limitations	Moderate	20	Moist, mixed forest	High.
357	Slope	Competition	Severe	0	Moist, mixed forest	High.
360	Rock outcrop	Harsh climate	Slight	60	Subalpine forest	Very low.
365	Slope	No limitations	Severe	0	Moist, mixed forest	High.
370	Soil damage	No limitations	Severe	0	Moist, mixed forest	High.

TABLE 5.--TIMBER MANAGEMENT AND PRODUCTIVITY--Continued

Map symbol	Tractor operation	Regeneration	Sediment hazard	Non-forested area	Forest vegetative group	Relative productivity
				Pct		
381	Slope	Competition, insolation.	Severe	0	Dry, mixed forest	Low.
404	Soil damage	No limitations	Moderate	0	Moist, mixed forest	High.
405	Complex slope, soil damage, rock outcrop.	Harsh climate	Moderate	20	Subalpine forest	Very low.
406	Complex slope, soil damage.	Harsh climate	Moderate	0	Subalpine forest	Low.
407	Soil damage	Frost pockets, competition.	Severe	0	Moist, mixed forest	High.
408	Slope, rock outcrop.	No limitations	Severe	15	Moist, mixed forest	High.
502	Slope	Insolation, competition.	Slight	0	Dry, mixed forest	Moderate.
503	Slope, rock outcrop.	Insolation	Slight	50	Open-grown forest	Very low.
510	Complex slope	Insolation	Severe	0	Open-grown forest	Very low.
520	Soil damage	No limitations	Moderate	0	Moist, mixed forest	High.
522	Complex slope, soil damage.	No limitations	Moderate	0	Moist, mixed forest	High.
552	Slope	No limitations	Moderate	0	Moist, mixed forest	High.
555	Complex slope, soil damage, rock outcrop.	Competition	Moderate	20	Moist, mixed forest	High.
570	Slope	Insolation on southerly aspects.	Moderate	0	Moist, mixed forest Dry, mixed forest	High. Moderate.

TABLE 6.--ENGINEERING INDEX PROPERTIES

(Absence of an entry indicates that data were not estimated)

Map symbol	USDA texture	Unified classification	Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
				4	10	40	200		
			Pct					Pct	
101.									
102*----	Silt loam----------	ML	0-5	100	100	90-100	70-90	20-30	5-10
103*----	Very gravelly very fine sandy loam.	SM	0-40	80-90	40-60	30-50	12-20	---	NP
104-----	Very gravelly very fine sandy loam, silt.	SM, ML	0-40	50-100	30-100	20-100	12-90	0-35	NP-10
105*----	Very gravelly sandy loam, extremely gravelly sandy loam.	SM	0-5	50-70	30-60	30-50	12-20	---	NP
106*----	Very gravelly very fine sandy loam.	SM	0-40	50-70	40-60	30-50	12-20	---	NP
107*----	Very gravelly sandy loam	SM	0-50	50-75	30-50	50-60	12-15	---	NP
108*----	Silt loam, very fine sandy loam, very gravelly very fine sandy loam.	ML, SM	0-30	50-100	30-100	20-100	12-90	0-35	NP-10
109-----	Extremely gravelly loamy sand.	SM	0-50	50-80	40-60	30-50	12-15	---	NP
110-----	Very fine sandy loam----	SM	0-5	100	100	90-100	40-50	---	NP
111*----	Very fine sandy loam, loamy fine sand.	SM	0-5	100	100	90-100	40-50	---	NP
112-----	Silty clay----------	CL	0-5	100	95-100	90-100	90-100	30-40	10-15
114-----	Silt----------	ML	0-5	100	100	90-100	70-90	20-30	5-10
201-----	Fractured bedrock-------	---	---	---	---	---	---	---	---
251-----	Extremely gravelly very fine sandy loam.	GW-GM	10-50	20-30	20-30	15-25	5-12	---	NP
252-----	Extremely gravelly very fine sandy loam.	GM	10-50	35-45	35-45	25-35	15-20	---	NP
301-----	Very gravelly fine sandy loam, loamy sand.	SM	0-40	50-60	45-50	40-45	12-20	---	NP
302-----	Very gravelly fine sandy loam.	SM	0-40	50-60	45-50	35-45	12-20	---	NP
303-----	Fractured bedrock-------	---	---	---	---	---	---	---	---
321*----	Very gravelly loam------	ML	0-40	50-60	45-55	40-50	20-30	15-25	0-5
322-----	Gravelly clay loam------	CL	0-15	60-70	55-65	50-55	45-55	25-35	7-15
323*----	Silty clay loam, gravelly silty clay loam.	CL	0-15	60-70	60-70	50-60	40-50	25-35	10-15

TABLE 6.--ENGINEERING INDEX PROPERTIES--Continued

Map symbol	USDA texture	Unified classification	Fragments > 3 inches	Percentage passing sieve number--4	10	40	200	Liquid limit	Plasticity index
			Pct					Pct	
324-----	Very gravelly fine sandy loam.	SM	0-40	50-60	45-55	40-50	25-35	---	NP
325*----	Silt loam----------	ML	0-5	85-95	80-90	75-85	65-75	15-25	5-10
328-----	Very gravelly sandy loam	SM	0-40	50-60	50-60	45-55	30-45	---	NP
329-----	Very gravelly sandy loam	SM	0-40	50-60	45-55	40-50	25-40	---	NP
351-----	Very gravelly very fine sandy loam.	SM	0-40	50-60	35-45	30-40	25-35	---	NP
352-----	Very gravelly very fine sandy loam.	SM	0-40	50-60	40-50	35-40	30-40	---	NP
353-----	Very stony sandy loam---	GM	30-50	30-40	25-35	20-30	12-20	---	NP
	Fractured bedrock-------	---	---	---	---	---	---	---	---
355-----	Very gravelly very fine sandy loam.	SM	0-40	50-60	40-50	35-45	12-20	---	NP
357-----	Very stony sandy loam---	GM	30-50	35-45	35-45	30-40	12-20	---	NP
	Fractured bedrock-------	---	---	---	---	---	---	---	---
360-----	Fractured bedrock-------	---	---	---	---	---	---	---	NP
365-----	Very gravelly very fine sandy loam.	SM	0-40	50-60	30-40	25-35	12-20	---	NP
370-----	Very gravelly loamy sand	GP-GM	0-40	40-50	35-45	20-30	5-12	---	NP
381-----	Fractured bedrock-------	---	---	---	---	---	---	---	---
	Extremely gravelly very fine sandy loam-------	GM	10-50	40-50	30-40	25-30	12-20	---	NP
401-----	Fractured bedrock-------	---	---	---	---	---	---	---	---
	Very stony sandy loam---	GM	30-50	25-35	20-30	15-25	12-20	---	NP
403-----	Fractured bedrock-------	---	---	---	---	---	---	---	---
404-----	Very stony sandy loam---	GM	30-50	35-45	35-45	30-40	12-20	---	NP
405-----	Fractured bedrock-------	---	---	---	---	---	---	---	---
	Very stony sandy loam---	GM	30-50	30-40	30-40	25-35	12-20	---	NP
406-----	Very stony sandy loam---	SM	30-50	50-60	40-50	35-45	12-20	---	NP
407-----	Very stony sandy loam---	SM	30-50	50-60	40-50	30-40	12-20	---	NP
408-----	Very stony sandy loam---	SM	30-50	50-60	30-40	25-35	12-20	---	NP
502-----	Extremely gravelly very fine sandy loam.	GM	10-50	30-40	30-40	25-30	12-20	---	NP
503-----	Fractured bedrock-------	---	---	---	---	---	---	---	---
510-----	Extremely gravelly silt loam.	GM	10-50	30-40	30-40	25-35	20-30	10-20	0-5
520-----	Sand----------	SP	0-5	55-65	30-40	10-40	0-5	---	NP
522-----	Very cobbly coarse sand	GP	30-50	30-40	25-35	20-30	0-5	---	NP

TABLE 6.--ENGINEERING INDEX PROPERTIES--Continued

Map symbol	USDA texture	Unified classification	Fragments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
			Pct					Pct	
552-----	Extremely gravelly very fine sandy loam.	GM	10-50	35-45	30-40	25-30	12-20	---	NP
555-----	Extremely stony sandy loam.	GM-GW	50-70	25-35	20-30	10-20	5-12	---	NP
570-----	Very gravelly loamy sand Fractured bedrock-------	GP-GM ---	10-70 ---	40-50 ---	35-45 ---	20-30 ---	5-12 ---	--- ---	NP ---

* Estimates given are for the subsoil.

TABLE 7.--ROAD CONSTRUCTION AND MAINTENANCE

Map symbol	Excavation	Maintenance of cut and fill areas	Fill material used for surfacing roads	Revegetation	Sediment hazard on roads
101	No limitations	No limitations	Tread erosion	No limitations	Severe.
102	No limitations	No limitations	Rut formation	Soil crusting	Severe.
103	No limitations	No limitations	Tread erosion	No limitations	Severe.
104:					
Andic Dystrochrepts	No limitations	Cutbank slough	Tread erosion	Soil crusting	Moderate.
Umbric Vitrandepts	Wetness	No limitations	No limitations	No limitations	Moderate.
105	Wetness	No limitations	No limitations	No limitations	Moderate.
106	No limitations	No limitations	Tread erosion	No limitations	Moderate.
107	No limitations	No limitations	Tread erosion	Moisture stress	Moderate.
108:					
Andic Dystric Eutrochrepts	No limitations	No limitations	Rut formation	No limitations	Severe.
Andic Dystrochrepts	No limitations	No limitations	Tread erosion	No limitations	Moderate.
109	No limitations	No limitations	Tread erosion	Moisture stress	Severe.
110	No limitations	No limitations	Rut formation	No limitations	Severe.
111	No limitations	No limitations	Rut formation	Moisture stress	Severe.
112	No limitations	Cutbank slough	Rut formation	Soil crusting	Severe.
114	No limitations	No limitations	Rut formation	Soil crusting, moisture stress.	Severe.
201	Hard rock, slope.	No limitations	Large stones, rock fall.	Moisture stress	Moderate.
251	Hard rock, slope.	No limitations	Large stones, rock fall.	Moisture stress	Moderate.
252	Slope	No limitations	Rock fall	Moisture stress	Moderate.
301	No limitations	Cutbank slough	Tread erosion	Soil crusting, moisture stress.	Moderate.
302	No limitations	Cutbank slough	Tread erosion	Soil crusting, moisture stress.	Moderate.
303	Hard rock	No limitations	Large stones	Moisture stress	Slight.
321	No limitations	Cutbank slough	Tread erosion	Soil crusting	Moderate.
322	No limitations	Cutbank slough	Rut formation	Soil crusting	Severe.
323	No limitations	Cutbank slough	Rut formation	Soil crusting	Severe.
324	No limitations	Cutbank slough	Tread erosion	Soil crusting	Moderate.
325	Wetness	Cutbank slough	Rut formation	No limitations	Severe.
328	No limitations	Cutbank slough	Tread erosion	Soil crusting	Moderate.

TABLE 7.--ROAD CONSTRUCTION AND MAINTENANCE--Continued

Map symbol	Excavation	Maintenance of cut and fill areas	Fill material used for surfacing roads	Revegetation	Sediment hazard on roads
329	No limitations	Cutbank slough	Tread erosion	Soil crusting	Moderate.
351	No limitations	Landslides, cutbank slough.	Tread erosion	Soil crusting	Severe.
352	No limitations	Cutbank slough	Tread erosion	Soil crusting	Moderate.
353	Hard rock	No limitations	Large stones	Moisture stress	Slight.
355	Hard rock	No limitations	Large stones	Moisture stress	Moderate.
357	Hard rock	Landslides	Large stones	Moisture stress	Severe.
360	Hard rock	No limitations	Large stones	Moisture stress	Slight.
365	Slope	Landslides, cutbank slough.	Tread erosion	Soil crusting	Severe.
370	No limitations	Cutbank ravel	Too sandy, tread erosion.	No limitations	Severe.
381	Hard rock	Landslides, cutbank slough.	Tread erosion	Soil crusting, moisture stress.	Severe.
401	Hard rock, slope.	Avalanches	Large stones, rock fall.	Moisture stress	Moderate.
403	Hard rock, slope.	Avalanches	Large stones, rock fall.	Moisture stress	Moderate.
404	No limitations	Cutbank ravel	Tread erosion, large stones.	No limitations	Moderate.
405	Hard rock	No limitations	Large stones	Harsh climate	Slight.
406	No limitations	Cutbank ravel	No limitations	Harsh climate	Slight.
407	No limitations	Cutbank ravel	Tread erosion, large stones.	No limitations	Severe.
408	Slope, hard rock.	No limitations	Large stones, rock fall.	Moisture stress	Moderate.
502	No limitations	No limitations	No limitations	Moisture stress	Slight.
503	Hard rock	No limitations	Large stones	Moisture stress	Slight.
510	No limitations	No limitations	No limitations	Moisture stress	Slight.
520	No limitations	Cutbank ravel	Too sandy, tread erosion.	No limitations	Severe.
522	No limitations	Cutbank ravel	Too sandy, tread erosion.	No limitations	Severe.
552	No limitations	No limitations	No limitations	No limitations	Slight.
555	Hard rock	No limitations	Large stones	No limitations	Slight.
570	No limitations	Cutbank ravel	Too sandy, tread erosion.	Moisture stress on south aspects.	Severe.

TABLE 8.--SOIL EROSION AND SEDIMENTATION

Map symbol	Susceptibility of the soil to erosion		Sediment delivery efficiency
	Surface layer	Lower layer	
101	Moderate	Severe	High.
102	Moderate	Severe	Low.
103	Moderate	Severe	High.
104	Severe	Severe	Low.
105	Moderate	Severe	Low.
106	Moderate	Severe	Low.
107	Slight	Severe	Low.
108	Severe	Severe	Low.
109	Moderate	Severe	High.
110	Moderate	Severe	Low.
111	Severe	Severe	Low.
112	Moderate	Severe	Low.
114	Severe	Severe	Low.
201	Slight	Slight	High.
251	Moderate	Slight	High.
252	Moderate	Slight	High.
301	Moderate	Moderate	Moderate.
302	Moderate	Moderate	Moderate.
303	Slight	Slight	Low.
321	Moderate	Moderate	Low.
322	Moderate	Severe	Low.
323	Severe	Severe	Low.
324	Moderate	Moderate	Low.
325	Severe	Moderate	High.
328	Moderate	Moderate	Moderate.
329	Moderate	Moderate	Low.
351	Moderate	Moderate	High.
352	Moderate	Moderate	Moderate.
353	Moderate	Slight	Low.
355	Moderate	Moderate	Moderate.
357	Moderate	Moderate	High.
360	Slight	Slight	Low.
365	Moderate	Moderate	High.

TABLE 8.--SOIL EROSION AND SEDIMENTATION--Continued

Map symbol	Susceptibility of the soil to erosion		Sediment delivery efficiency
	Surface layer	Lower layer	
370	Moderate	Severe	Moderate.
381	Moderate	Moderate	High.
401	Moderate	Slight	High.
403	Moderate	Slight	High.
404	Moderate	Moderate	Low.
405	Moderate	Slight	Low.
406	Moderate	Slight	Low.
407	Moderate	Moderate	High.
408	Moderate	Slight	High.
502	Slight	Slight	Moderate.
503	Slight	Slight	Moderate.
510	Severe	Slight	Moderate.
520	Moderate	Severe	Moderate.
522	Moderate	Severe	Moderate.
552	Moderate	Slight	Moderate.
555	Moderate	Slight	Moderate.
570	Moderate	Severe	Moderate.

TABLE 9.--CLASSIFICATION OF THE SOILS (GROUPED BY SUBORDER)

Suborder	Family or higher taxonomic classification
Andepts	Umbric Vitrandepts, medial over loamy, mixed, frigid
Aquolls	Aeric Calciaquolls, fine-silty, frigid
Boralfs	Typic Eutroboralfs, fine-loamy, mixed Typic Eutroboralfs, loamy-skeletal, mixed Eutric Glossoboralfs, fine, illitic Eutric Glossoboralfs, fine, mixed
Fluvents	Fluvents Aquic Udifluvents, coarse-loamy, mixed, frigid
Ochrepts	Andic Cryochrepts, loamy-skeletal, mixed Lithic Cryochrepts, loamy-skeletal, mixed Andic Dystrochrepts, loamy-skeletal, mixed, frigid Eutrochrepts, coarse-loamy, mixed, frigid Andic Dystric Eutrochrepts, fine-silty, mixed, frigid Andic Dystric Eutrochrepts, sandy, micaceous, frigid Dystric Eutrochrepts, loamy-skeletal, mixed, frigid Typic Eutrochrepts, loamy-skeletal, mixed, frigid Lithic Ustochrepts, loamy-skeletal, mixed, frigid Typic Ustochrepts, loamy-skeletal, mixed, frigid Calcixerollic Xerochrepts, coarse-loamy, mixed, frigid Typic Xerochrepts, fine-silty, mixed, frigid Typic Xerochrepts, loamy-skeletal, mixed, frigid
Xerolls	Typic Calcixerolls, loamy-skeletal, mixed, frigid

TABLE 10.--CLASSIFICATION OF THE SOILS IN THE DETAILED SOIL MAP UNITS

Map symbol	Family or higher taxonomic classification
101	Fluvents
102	Andic Dystric Eutrochrepts, fine-silty, mixed, frigid
103	Andic Dystrochrepts, loamy-skeletal, mixed, frigid
104	Andic Dystrochrepts, loamy-skeletal, mixed, frigid; Umbric Vitrandepts, medial over loamy, mixed, frigid
105	Aquic Udifluvents, coarse-loamy, mixed, frigid
106	Andic Dystrochrepts, loamy-skeletal, mixed, frigid
107	Typic Xerochrepts, loamy-skeletal, mixed, frigid
108	Andic Dystric Eutrochrepts, fine-silty, mixed, frigid; Andic Dystrochrepts, loamy-skeletal, mixed, frigid
109	Typic Xerochrepts, loamy-skeletal, mixed, frigid
110	Eutrochrepts, coarse-loamy, mixed, frigid
111	Calcixerollic Xerochrepts, coarse-loamy, mixed, frigid
112	Eutric Glossoboralfs, fine, illitic
114	Typic Xerochrepts, fine-silty, mixed, frigid
201	Lithic Ustochrepts, loamy-skeletal, mixed, frigid; Typic Ustochrepts, loamy-skeletal, mixed, frigid
251	Andic Dystrochrepts, loamy-skeletal, mixed, frigid
252	Andic Dystrochrepts, loamy-skeletal, mixed, frigid
301	Dystric Eutrochrepts, loamy-skeletal, mixed, frigid
302	Typic Ustochrepts, loamy-skeletal, mixed, frigid
303	Lithic Ustochrepts, loamy-skeletal, mixed, frigid
321	Typic Eutroboralfs, loamy-skeletal, mixed
322	Eutric Glossoboralfs, fine, mixed
323	Typic Eutroboralfs, fine-loamy, mixed
324	Typic Eutrochrepts, loamy-skeletal, mixed, frigid
325	Aeric Calciaquolls, fine-silty, frigid
328	Andic Cryochrepts, loamy-skeletal, mixed
329	Andic Cryochrepts, loamy-skeletal, mixed
351	Andic Dystrochrepts, loamy-skeletal, mixed, frigid
352	Andic Dystrochrepts, loamy-skeletal, mixed, frigid
353	Andic Cryochrepts, loamy-skeletal, mixed; Lithic Cryochrepts, loamy-skeletal, mixed
355	Andic Dystrochrepts, loamy-skeletal, mixed, frigid

TABLE 10.--CLASSIFICATION OF THE SOILS IN THE DETAILED SOIL MAP UNITS--Continued

Map symbol	Family or higher taxonomic classification
357	Andic Cryochrepts, loamy-skeletal, mixed; Lithic Cryochrepts, loamy-skeletal, mixed
360	Lithic Cryochrepts, loamy-skeletal, mixed
365	Andic Dystrochrepts, loamy-skeletal, mixed, frigid
370	Andic Dystrochrepts, loamy-skeletal, mixed, frigid
381	Typic Ustochrepts, loamy-skeletal, mixed, frigid; Lithic Ustochrepts, loamy-skeletal, mixed, frigid
401	Andic Cryochrepts, loamy-skeletal, mixed; Lithic Cryochrepts, loamy-skeletal, mixed
403	Lithic Cryochrepts, loamy-skeletal, mixed; Andic Cryochrepts, loamy-skeletal, mixed
404	Andic Cryochrepts, loamy-skeletal, mixed
405	Lithic Cryochrepts, loamy-skeletal, mixed; Andic Cryochrepts, loamy-skeletal, mixed
406	Andic Cryochrepts, loamy-skeletal, mixed
407	Andic Cryochrepts, loamy-skeletal, mixed
408	Andic Cryochrepts, loamy-skeletal, mixed
502	Typic Ustochrepts, loamy-skeletal, mixed, frigid
503	Lithic Ustochrepts, loamy-skeletal, mixed, frigid
510	Typic Calcixerolls, loamy-skeletal, mixed, frigid
520	Andic Dystric Eutrochrepts, sandy, micaceous, frigid
522	Andic Dystrochrepts, loamy-skeletal, mixed, frigid
552	Andic Dystrochrepts, loamy-skeletal, mixed, frigid
555	Andic Cryochrepts, loamy-skeletal, mixed
570	Andic Dystrochrepts, loamy-skeletal, mixed, frigid; Typic Ustochrepts, loamy-skeletal, mixed, frigid

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