



United States
Department of
Agriculture

Soil
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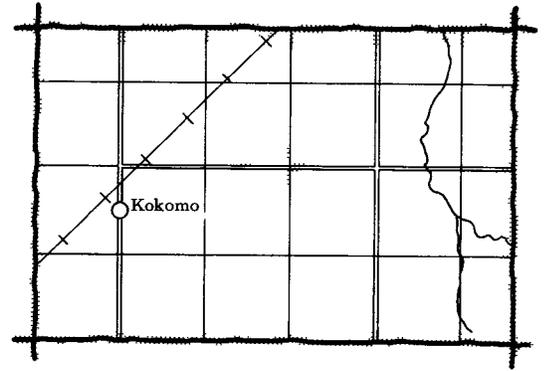
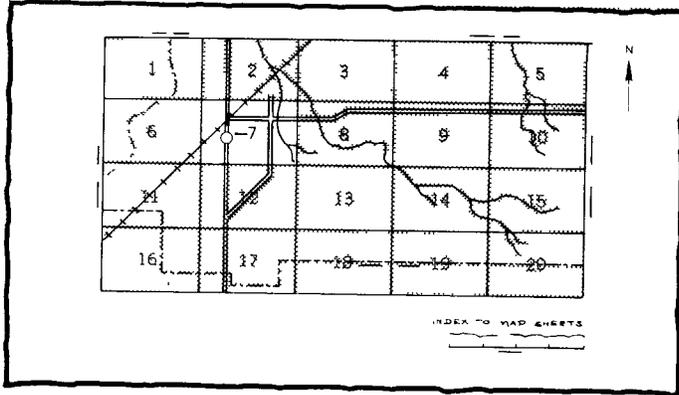
In Cooperation with
United States Department
of Agriculture,
Forest Service, and
University of California
Agricultural Experiment
Station

Soil Survey of Siskiyou County California Central Part



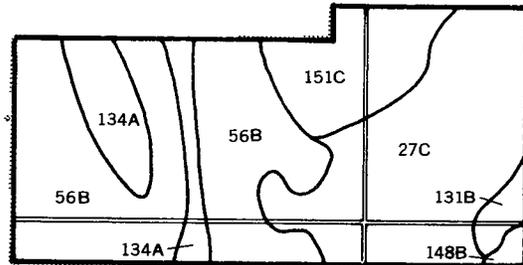
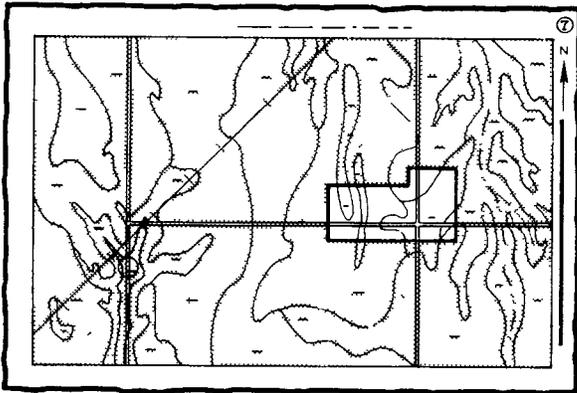
HOW TO USE

1. Locate your area of interest on the "Index to Map Sheets" (the last page of this publication).

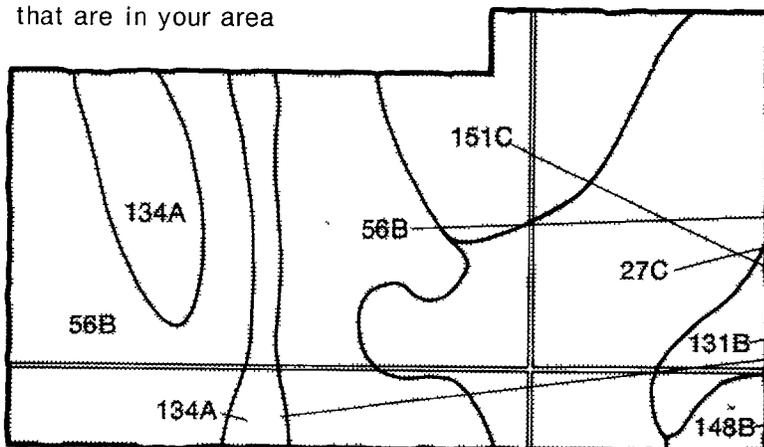


2. Note the number of the map sheet and turn to that sheet.

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



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

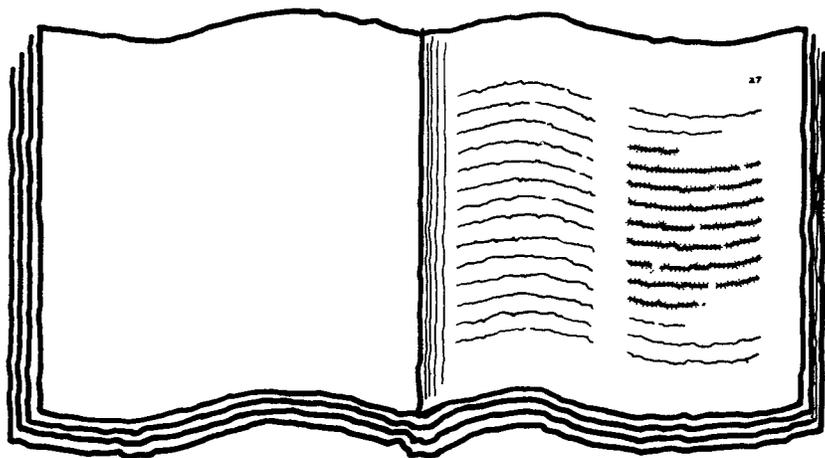


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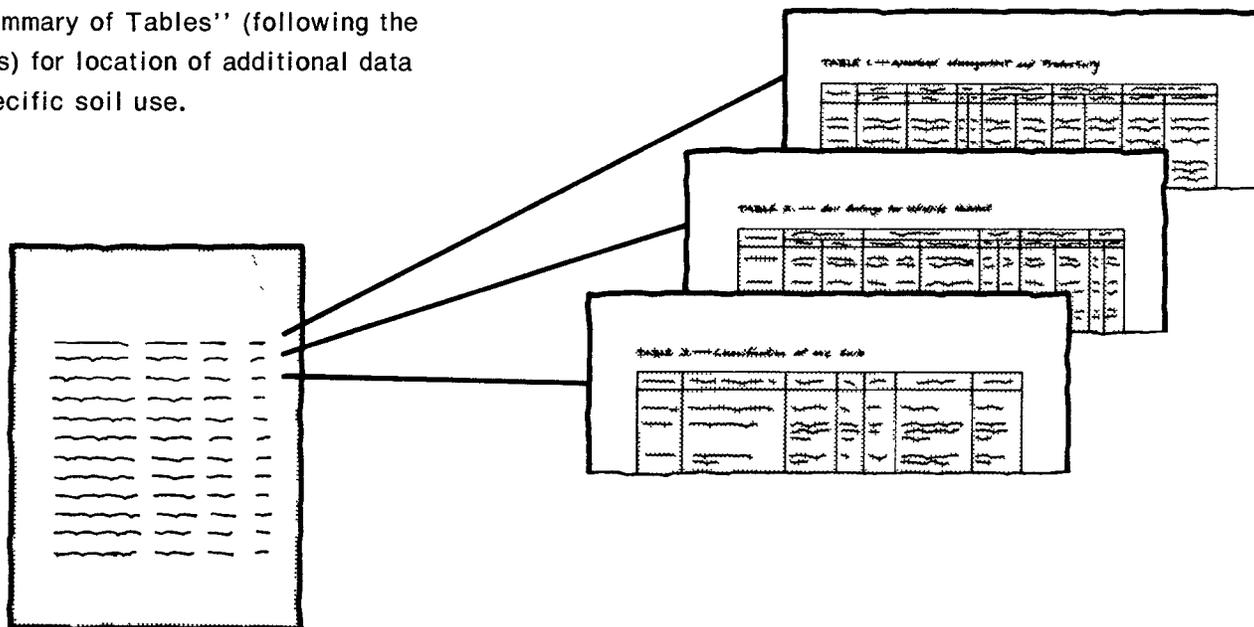
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- 134A
- 148B
- 151C

THIS SOIL SURVEY

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

A detailed illustration of a table with multiple columns and rows of text, representing the 'Index to Soil Map Units'. The text is arranged in a structured, tabular format.

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



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

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was performed in the period 1962-76. Soil names and descriptions were approved in 1978. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1978. This survey was made cooperatively by the Soil Conservation Service, the Forest Service, and the University of California Agricultural Experiment Station. It is part of the technical assistance furnished to the Shasta Valley and Siskiyou Resource Conservation Districts.

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

Cover: Typical landscape in the survey area. The bales of straw are on Lassen soils. Lassen, Kuck, and Mary soils are in the background. Mt. Shasta is in the far background.

contents

Index to map units	v	Windbreaks and environmental plantings.....	97
Summary of tables	vii	Recreation.....	98
Preface	ix	Wildlife habitat.....	98
General nature of the survey area.....	1	Engineering.....	100
How this survey was made.....	4	Soil properties	105
General soil map units	5	Engineering index properties.....	105
Map unit descriptions.....	5	Physical and chemical properties.....	106
Detailed soil map units	13	Soil and water features.....	107
Map unit descriptions.....	13	Classification of the soils	109
Use and management of the soils	91	Soil series and their morphology.....	109
Crops and pasture.....	91	References	151
Rangeland.....	95	Glossary	153
Woodland management and productivity.....	96	Tables	161
Woodland understory vegetation.....	97		

soil series

Asta series.....	109	Jenny series.....	128
Atter series.....	111	Jilson series.....	128
Avis series.....	111	Kindig series.....	129
Bogus series.....	113	Kinkel series.....	129
Bonnet series.....	113	Kuck series.....	130
Boomer series.....	114	Lassen series.....	131
Boomer Variant.....	115	Louie series.....	132
Chaix series.....	115	Louie Variant.....	132
Chawanakee series.....	116	Marpa series.....	133
Copsey series.....	116	Mary series.....	133
Deetz series.....	117	Medford series.....	134
Delaney series.....	118	Montague series.....	135
Delaney Variant.....	118	Montague Variant.....	135
Deven series.....	119	Neer series.....	135
Diyou series.....	119	Neuns series.....	136
Dotta series.....	120	Odas series.....	137
Dubakella series.....	120	Oosen series.....	137
Duzel series.....	122	Orset series.....	139
Esro series.....	122	Pinehurst series.....	139
Etsel series.....	123	Pinehurst Variant.....	140
Facey series.....	123	Pit series.....	141
Gazelle series.....	124	Plutos series.....	141
Gazelle Variant.....	125	Ponto series.....	142
Hilt series.....	125	Redola series.....	142
Iller series.....	126	Salisbury series.....	143
Ipish series.....	127		

Settemeyer series.....	144	Stoner series.....	147
Settemeyer Variant.....	144	Terwilliger series.....	147
Sheld series	145	Uhlig Variant.....	148
Snell series.....	146	Weitchpec Variant	149

Issued August 1983

index to map units

101—Asta gravelly sandy loam, 5 to 15 percent slopes.....	13	134—Delaney Variant silt, 0 to 2 percent slopes.....	31
102—Asta gravelly sandy loam, 15 to 50 percent slopes.....	14	135—Deven-Rubble land complex, 0 to 30 percent slopes.....	31
103—Asta cobbly sandy loam, 15 to 50 percent slopes.....	14	136—Diyou loam.....	32
104—Atter very gravelly sandy loam, 0 to 5 percent slopes.....	15	137—Diyou loam, drained.....	32
105—Atter very cobbly sandy loam, 0 to 5 percent slopes.....	15	138—Diyou loam, peat substratum.....	33
106—Atter very bouldery loamy fine sand, 5 to 30 percent slopes.....	15	139—Dotta loam, 0 to 2 percent slopes.....	33
107—Avis-Oosen complex, 5 to 30 percent slopes ...	16	140—Dotta loam, 2 to 9 percent slopes.....	34
108—Avis-Oosen complex, 30 to 50 percent slopes.	16	141—Dotta gravelly loam, 0 to 2 percent slopes.....	34
109—Avis-Lava flows complex, 5 to 30 percent slopes.....	17	142—Dotta gravelly loam, 2 to 5 percent slopes.....	35
110—Bogus stony loam, 15 to 50 percent slopes.....	18	143—Dubakella-lpish complex, 5 to 30 percent slopes.....	36
111—Bogus very stony loam, 15 to 50 percent slopes.....	18	144—Dubakella-lpish complex, 30 to 50 percent slopes.....	36
112—Bonnet loam, 0 to 2 percent slopes.....	19	145—Dumps.....	37
113—Bonnet gravelly loam, 0 to 2 percent slopes.....	19	146—Duzel gravelly loam, 5 to 9 percent slopes.....	37
114—Bonnet gravelly loam, 2 to 5 percent slopes.....	20	147—Duzel gravelly loam, 9 to 15 percent slopes.....	37
115—Boomer loam, cool, 5 to 30 percent slopes.....	20	148—Duzel-Jilson-Facey complex, 15 to 50 percent slopes.....	38
116—Boomer, cool-Neuns complex, 30 to 70 percent slopes.....	21	149—Esro silt loam.....	38
117—Boomer Variant sandy loam, 30 to 50 percent slopes.....	22	150—Esro silt loam, drained.....	39
118—Boomer Variant stony sandy loam, 5 to 30 percent slopes.....	22	151—Etsel very gravelly loam, 30 to 75 percent slopes.....	39
119—Chaix-Chawanakee gravelly coarse sandy loams, 5 to 30 percent slopes.....	22	152—Facey loam, 5 to 15 percent slopes.....	40
120—Chaix-Chawanakee gravelly coarse sandy loams, 30 to 50 percent slopes.....	23	153—Gazelle silt loam.....	40
121—Chaix-Chawanakee gravelly coarse sandy loams, 50 to 70 percent slopes.....	24	154—Gazelle Variant sandy clay loam.....	41
122—Copsey clay, 0 to 9 percent slopes.....	25	155—Hilt sandy loam, 2 to 15 percent slopes.....	42
123—Copsey gravelly clay, 2 to 9 percent slopes.....	25	156—Hilt sandy loam, 15 to 30 percent slopes.....	42
124—Copsey cobbly clay, 2 to 9 percent slopes.....	26	157—Hilt stony sandy loam, 2 to 50 percent slopes..	42
125—Deetz gravelly loamy sand, 0 to 5 percent slopes.....	26	158—Hilt-Rock outcrop complex, 2 to 50 percent slopes.....	43
126—Deetz gravelly loamy sand, 5 to 15 percent slopes.....	26	159—Jenny clay, 0 to 2 percent slopes.....	43
127—Deetz stony loamy sand, 2 to 15 percent slopes.....	27	160—Jenny clay, 2 to 15 percent slopes.....	44
128—Deetz stony loamy sand, 15 to 30 percent slopes.....	28	161—Jenny cobbly clay, 0 to 15 percent slopes.....	45
129—Delaney sand, 0 to 9 percent slopes.....	28	162—Jilson gravelly loam, 50 to 65 percent slopes...	46
130—Delaney gravelly sand, 0 to 9 percent slopes...	29	163—Jilson-Duzel gravelly loams, 5 to 50 percent slopes.....	46
131—Delaney stony sand, 0 to 15 percent slopes.....	29	164—Kindig-Neuns gravelly loams, 15 to 50 percent slopes.....	46
132—Delaney sandy loam, 0 to 2 percent slopes.....	30	165—Kindig-Neuns gravelly loams, 50 to 80 percent slopes.....	47
133—Delaney sandy loam, 2 to 5 percent slopes.....	30	166—Kinkel very gravelly loam, 2 to 15 percent slopes.....	48
		167—Kuck clay loam, 2 to 9 percent slopes.....	48
		168—Kuck clay loam, 9 to 15 percent slopes.....	49
		169—Lassen clay, 2 to 9 percent slopes.....	50
		170—Lassen clay, 9 to 15 percent slopes.....	51
		171—Lassen cobbly clay, 2 to 15 percent slopes.....	52
		172—Lassen-Kuck complex, 15 to 50 percent slopes.....	52

173—Lassen-Kuck complex, stony, 2 to 50 percent slopes.....	53	208—Ponto sandy loam, 5 to 15 percent slopes.....	72
174—Lassen-Rock outcrop-Kuck complex, 2 to 50 percent slopes	54	209—Ponto-Neer complex, 2 to 15 percent slopes ...	72
175—Lava flows.....	54	210—Redola loam, 0 to 2 percent slopes	73
176—Lava flows-Xerorthents complex, 0 to 50 percent slopes	55	211—Redola loam, 2 to 9 percent slopes	74
177—Lithic Haploxerolls-Rock outcrop complex, 0 to 65 percent slopes	55	212—Riverwash	74
178—Lithic Xerorthents-Rock outcrop complex, 0 to 65 percent slopes.....	55	213—Rock outcrop-Dubakella complex, 30 to 50 percent slopes	75
179—Louie loam, 0 to 2 percent slopes.....	55	214—Rock outcrop-Louie complex, 0 to 15 percent slopes.....	75
180—Louie loam, 2 to 9 percent slopes.....	56	215—Rock outcrop-Terwilliger complex, 2 to 50 percent slopes	75
181—Louie stony loam, 0 to 9 percent slopes.....	57	216—Rock outcrop	76
182—Louie Variant sandy clay loam, 2 to 9 percent slopes.....	57	217—Salisbury clay loam, 0 to 2 percent slopes.....	77
183—Marpa-Kinkel-Boomer, cool complex, 5 to 15 percent slopes	58	218—Salisbury clay loam, 2 to 9 percent slopes.....	77
184—Marpa-Kinkel-Boomer, cool complex, 15 to 50 percent slopes	58	219—Salisbury gravelly clay loam, 0 to 5 percent slopes.....	78
185—Mary loam, 2 to 9 percent slopes.....	59	220—Salisbury gravelly clay loam, 5 to 9 percent slopes.....	79
186—Mary loam, 9 to 15 percent slopes.....	60	221—Salisbury cobbly loam, 0 to 9 percent slopes ...	79
187—Mary stony loam, 2 to 50 percent slopes.....	60	222—Settlemeier loam, 0 to 2 percent slopes.....	80
188—Mary-Rock outcrop complex, 2 to 50 percent slopes.....	60	223—Settlemeier loam, drained, 2 to 5 percent slopes.....	80
189—Medford clay loam, cool, 0 to 2 percent slopes.....	61	224—Settlemeier Variant silt loam.....	81
190—Medford clay loam, cool, 2 to 5 percent slopes.....	61	225—Sheld very stony sandy loam, 50 to 65 percent slopes	81
191—Medford clay loam, cool, 5 to 15 percent slopes.....	62	226—Sheld-Ilter stony sandy loams, 9 to 30 percent slopes.....	82
192—Montague clay, 0 to 2 percent slopes.....	63	227—Sheld-Ilter stony sandy loams, 30 to 50 percent slopes	83
193—Montague clay, 2 to 9 percent slopes.....	63	228—Snell very stony loam, 5 to 30 percent slopes..	83
194—Montague cobbly clay, 0 to 9 percent slopes ...	64	229—Stoner gravelly sandy loam, 0 to 2 percent slopes.....	84
195—Montague Variant clay, 0 to 9 percent slopes ..	65	230—Stoner gravelly sandy loam, 2 to 5 percent slopes.....	84
196—Neer-Ponto stony sandy loams, 15 to 50 percent slopes	65	231—Stoner gravelly sandy loam, 5 to 15 percent slopes.....	85
197—Neer-Ponto complex, 15 to 50 percent slopes .	66	232—Terwilliger silty clay loam, 2 to 9 percent slopes.....	86
198—Odas sandy loam.....	67	233—Terwilliger silty clay loam, 9 to 15 percent slopes.....	87
199—Oosen loamy sand, 2 to 15 percent slopes	68	234—Terwilliger silty clay loam, 15 to 50 percent slopes.....	87
200—Orset sandy loam, 0 to 9 percent slopes.....	68	235—Terwilliger stony silty clay loam, 2 to 50 percent slopes	88
201—Pinehurst stony loam, 2 to 15 percent slopes...	69	236—Uhlig Variant stony loam, 5 to 50 percent slopes.....	88
202—Pinehurst stony loam, 15 to 30 percent slopes	69	237—Weitchpec Variant-Rock outcrop complex, 5 to 65 percent slopes.....	89
203—Pinehurst stony loam, 30 to 50 percent slopes	70	238—Xerofluvents, nearly level.....	89
204—Pinehurst Variant very stony loam, 0 to 15 percent slopes	70		
205—Pinehurst Variant very stony loam, 15 to 65 percent slopes	70		
206—Pit clay.....	71		
207—Plutos-Rock outcrop complex, 0 to 30 percent slopes.....	72		

summary of tables

Temperature and precipitation (table 1).....	162
Freeze dates in spring and fall (table 2).....	165
<i>Probability. Temperature.</i>	
Growing season (table 3).....	167
<i>Probability. Daily minimum temperature.</i>	
Acreage and proportionate extent of the soils (table 4).....	168
<i>Acres. Percent.</i>	
Yields per acre of irrigated and nonirrigated crops and pasture (table 5)...	171
<i>Pasture. Barley. Grass-legume hay. Wheat.</i>	
Storie index rating (table 6).....	174
<i>Rating factors. Index. Grade. Limitation in X factor.</i>	
Rangeland productivity and characteristic plant communities (table 7).....	181
<i>Range site name. Total production. Characteristic vegetation. Composition.</i>	
Woodland management and productivity (table 8).....	193
<i>Ordination symbol. Management concerns. Potential productivity. Trees to plant.</i>	
Woodland understory vegetation (table 9).....	199
<i>Total production. Characteristic vegetation. Composition.</i>	
Windbreaks and environmental plantings (table 10).....	205
Recreational development (table 11).....	207
<i>Camp areas. Picnic areas. Playgrounds. Paths and trails.</i>	
Wildlife habitat potentials (table 12).....	217
<i>Potential for habitat elements. Potential as habitat for— Openland wildlife, Woodland wildlife, Wetland wildlife, Rangeland wildlife.</i>	
Building site development (table 13).....	224
<i>Shallow excavations. Dwellings without basements. Small commercial buildings. Local roads and streets.</i>	
Sanitary facilities (table 14).....	232
<i>Septic tank absorption fields. Sewage lagoon areas. Trench sanitary landfill. Area sanitary landfill. Daily cover for landfill.</i>	
Construction materials (table 15).....	242
<i>Roadfill. Sand. Gravel. Topsoil.</i>	
Water management (table 16).....	252
<i>Limitations for—Pond reservoir areas; Embankments, dikes, and levees. Features affecting—Drainage, Irrigation, Terraces and diversions, Grassed waterways.</i>	

Engineering index properties (table 17)	261
<i>Depth. USDA texture. Classification—Unified, AASHTO.</i>	
<i>Fragments greater than 3 inches. Percentage passing</i>	
<i>sieve number—4, 10, 40, 200. Liquid limit. Plasticity index.</i>	
Physical and chemical properties of the soils (table 18)	275
<i>Depth. Clay less than 2 millimeters. Permeability. Available</i>	
<i>water capacity. Soil reaction. Salinity. Shrink-swell</i>	
<i>potential. Erosion factors. Wind erodibility group. Organic</i>	
<i>matter.</i>	
Soil and water features (table 19).....	284
<i>Hydrologic group. Flooding. High water table. Bedrock.</i>	
<i>Cemented pan. Risk of corrosion.</i>	
Classification of the soils (table 20).....	291
<i>Family or higher taxonomic class.</i>	

preface

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

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

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

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



Location of Siskiyou County, Central Part, in California

soil survey of Siskiyou County, California Central Part

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United States Department of Agriculture, Soil Conservation Service
and Forest Service, in cooperation with University of California
Agricultural Experiment Station

SISKIYOU COUNTY, CENTRAL PART, is in the northern part of California. The survey area is 887,765 acres, or about 1,387 square miles in size. It is bordered on the west by the Klamath National Forest, on the south by the Shasta-Trinity National Forest, on the east by the Klamath National Forest, and on the north by the State of Oregon.

An older survey, "The Shasta Valley Area," was published in 1923 (11). This earlier survey covers a part of the present survey. The present survey, however, updates the earlier survey and provides additional information and larger maps that show the soils in greater detail.

Descriptions, names, and delineations of soils in this soil survey do not fully agree with those on soil maps for adjacent survey areas. Differences are the result of better knowledge of soils, modifications in series concepts, intensity of mapping, or the extent of soils within the survey area.

general nature of the survey area

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

history and development

The first exploration of the survey area on record was in the late 1820's, when a party of trappers representing the Hudson's Bay Company entered the area in search of pelts. Cattle drovers, trailing cattle from the Sacramento Valley to the Oregon settlements, soon followed. Except for an occasional small military mission, these were about the only explorers to enter the area until the 1849 Gold Rush.

Gold was discovered near the present town of Yreka by Abraham Thompson in 1851. Other discoveries in the area soon followed (5). The strikes on the Scott, Klamath, and Salmon Rivers and those near the towns of Callahan, Greenhorn, Deadwood, Hawkinsville, and Henley are the most notable. By 1852 the population had increased greatly. Not only miners, but businessmen, farmers, cattlemen, and craftsmen came to share in the wealth. The farmers raised vegetables, hay, and grain to meet the needs of the miners. Cattlemen used the grasslands and adjacent timberlands for livestock grazing. Their herds increased rapidly, as did the market for livestock.

The miners, farmers, and townspeople needed lumber. Early forest products were used in mining and for buildings. The lumbering industry has grown steadily since the arrival of the first settlers. Approximately 76 sawmills have operated in the survey area over the years. Originally, logging was done exclusively with man and animal power. Logs were cut by manpowered

crosscut saws and were dragged by animals or floated down streams to sawmills. After the advent of the railroad in the 1880's, many lumber companies switched to logging by train. At one time there were as many as 559 miles of logging railroads in Siskiyou County. After World War II, crawler tractors and trucks became a more economical way of transporting logs.

As the Gold Rush "boom" waned, the agricultural, lumbering, and mining industries were becoming firmly entrenched in the economic fabric of the survey area.

The town of Montague was founded in 1887 by L. D. Norton, who was an assistant engineer with the Southern Pacific Railroad. Norton was sent to this area to start a town along the railroad. The town was named in honor of W. W. Montague, who for many years was a civil engineer with the Central and Southern Pacific Railroads (14).

In the fall of 1951 the name of the town near the gold strike at Thompson's Dry Diggins was changed to Shasta Butte City. In order to avoid confusion with Shasta City, the name was later changed to Yreka. On April 21, 1857, the city of Yreka was legally incorporated. Yreka then became the county seat. Siskiyou County, as it now exists, was created in 1874 by the state legislature (6).

population trends

The population of the county has grown steadily. It climbed from 30,768 in 1965 to 33,231 in 1970 (10).

Yreka is the main urban center in the survey area. Minor urban centers are Grenada, Montague, Etna, Mount Shasta, Weed, and Fort Jones. The population of Yreka increased from 5,057 in 1965 to 5,515 in 1970. The percentage of the population that lives in urban centers is constantly increasing. In 1930 only 4 percent of the population of Siskiyou County lived in urban areas, but by 1965 it had expanded to 33 percent. A great many of the people leaving Siskiyou County are the young people who were born and raised there. They leave for higher education and improved job opportunities.

physiography, relief, and drainage

Shasta Valley is in the central part of the survey area. To the west of this valley is Scott Valley. The Klamath Mountain Range is on the west side of Scott Valley, and the Cascade Range is on the east side of Shasta Valley. The entire area is bordered on the north by the Siskiyou Mountains.

Shasta and Scott Valleys consist of young alluvial fans and old terraces. Shasta Valley is dotted with small hills. It is about 28 miles long and averages 10 miles in width. Scott Valley is about 20 miles long and 4 miles wide.

The highest elevations in the area are in the southeastern part. Goosenest Mountain has the highest elevation—8,298 feet. The lowest point in the area,

about 2,000 feet in elevation, is at the north end of Shasta Valley.

The principal drainage outlets in the area are the Shasta and Scott Rivers, both of which drain into the Klamath River. Drainage in both Shasta and Scott Valleys is from south to north.

climate

Prepared by the National Climatic Center, Asheville, North Carolina

The climate of Siskiyou County, Central Part, is greatly tempered by winds from the Pacific Ocean. Summers are fairly warm, but hot days are rare. Winters are cool, but snow and freezing temperatures are uncommon except at the higher elevations. Rainfall is extremely light in summer, so crops growing actively during this period need irrigation. Several weeks often pass without precipitation. During the rest of the year rains are frequent, especially late in fall and in winter.

Table 1 gives data on temperature and precipitation for the survey area, as recorded at Fort Jones, Mount Shasta, and Yreka, California, for the period 1951 to 1977. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperature at Fort Jones, Mount Shasta, and Yreka is 36 degrees F. The average daily minimum temperature is 25 degrees at Fort Jones, 27 degrees at Mount Shasta, and 26 degrees at Yreka. The lowest temperature on record, -20 degrees, occurred at Fort Jones on January 22, 1962. In summer the average temperature is 67 degrees at Fort Jones, 65 degrees at Mount Shasta, and 69 degrees at Yreka. The average daily maximum temperature is about 85 degrees. The highest recorded temperature, which occurred at both Fort Jones and Yreka on August 8, 1972, is 108 degrees.

Every few years, either in winter or summer, an invasion of a large continental airmass from the east causes abnormal temperatures. In winter several consecutive days are well below freezing; in summer a week or longer is sweltering.

Growing degree days, shown in table 1, are equivalent to heat units. During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (40 degrees). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is 23 inches at Fort Jones, 37 inches at Mount Shasta, and 19 inches at Yreka. Of this, 20 percent usually falls in April through September, which includes the growing season for most crops. The heaviest 1-day rainfall during the period of record was 5.07 inches at Mount Shasta on January 15, 1974. Thunderstorms occur on about 7 days each year, and most occur in summer.

Average seasonal snowfall is 30 inches at Fort Jones, 123 inches at Mount Shasta, and 24 inches at Yreka. The greatest snow depth at any one time during the period of record was 23 inches at Fort Jones, 54 inches at Mount Shasta, and 40 inches at Yreka. On the average, 10 days at Fort Jones and Yreka and 28 days at Mount Shasta have at least 1 inch of snow on the ground, but the number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 50 percent. Humidity is higher at night, and the average at dawn is about 70 percent.

In most winters, one or two storms over the whole area bring strong and sometimes damaging winds, and in some years the accompanying heavy rains cause serious flooding.

water supply

Water in this soil survey area is available from streams, reservoirs, springs, and wells. Quality of water is fair to good. Runoff from rainfall and snowfall in the Cascade, Siskiyou, and Klamath Mountains is the main source of water. The Shasta and Scott Rivers along with Dwinell Reservoir provide most of the surface water used for irrigation (4).

Water is provided throughout the area by many irrigation districts. The largest district, the Montague Water Conservation District, provides water from Dwinell Reservoir to irrigate more than 5,800 acres in Shasta Valley.

Ground water provides a small percentage of the water used for irrigation and domestic use in the area. The ground water is replenished by the deep percolation of direct precipitation and by seepage from streams and excess irrigation water in the area. The water supply in Shasta Valley is derived principally from precipitation and snowmelt from Mount Shasta (3).

There are several problems with the water supply in the area. The most serious one is the lack of sufficient water along the Scott River in summer. At times it is necessary to pump ground water near the river to provide water for irrigation.

vegetation

The natural vegetation in the survey area is broadly classified into four types: grassland, brushland, grazable woodland, and woodland. Soil and climate are important factors that determine the type and extent of natural vegetation. Within each of the four categories there are intergrades and variations in species composition. The principal variation is in the percentage of shrubby species present.

During recent and historical times, the original vegetative pattern of the survey area has undergone major alterations, which have contributed to soil erosion. The principal causes of these alterations have been cultivation, excessive grazing, and fire.

About 50 percent of the survey area was originally grassland. About 25 percent of the grassland is now used for grazing, and the rest is under cultivation or has been converted to other uses, such as urban development and roads. Heavy grazing pressure and the widespread droughts of the 1860's have reduced the extent of the native perennial grasses. Various species of annual grasses and forbs are now significant components of the vegetation on many range sites. Because of the climate in the survey area, however, perennial grasses such as bluebunch wheatgrass, beardless wheatgrass, Idaho fescue, and bottlebrush squirreltail are still dominant on well managed rangeland.

The soils between Shasta and Scott Valleys have a poor calcium-to-magnesium ratio and thus produce more brush than do any of the other soils in the area. The soils that are shallow or rocky, or both, and are in association with deeper soils also produce shrubby species such as manzanita and buckbrush. The clayey soils at the north end of Shasta Valley currently support a mixed plant community of scrubby oak trees, ceanothus shrubs, and both perennial and annual grasses. The better managed rangeland of this area is still dominated by perennial grasses.

The main areas of rangeland are around the perimeters of Scott and Shasta Valleys. Originally, both of these valleys were open grassland, but they have been converted to cropland in recent times. About 5 percent of the more sloping soils around the edges of these valleys have also been cleared of grass and shrubs and are used for dryland crops.

Grazable woodland occupies about 15 percent of the survey area. Areas of grazable woodland are dominantly between the open grassland areas at the lower elevations and the woodland areas at the higher elevations. In these areas, the vegetation consists of mixed conifers, oaks, shrubs, and grasses. The open tree canopy permits enough sunlight to reach the understory plants to provide some forage for livestock and wildlife. The understory on some of the soils is mainly shrubs such as ceanothus and manzanita. The deeper soils, however, produce abundant grass. The most common grasses are bluebunch wheatgrass, Idaho fescue, mountain brome, and Thurber needlegrass.

Woodland is on the uplands throughout the survey area. About 34 percent of the soils are classified as woodland soils. Typical trees include western juniper, on the foothills; predominantly ponderosa pine, at elevations of less than 3,000 feet; mixed conifers, ponderosa pine, sugar pine, Douglas-fir, white fir, and incense-cedar, between elevations of about 3,000 and 6,000 feet; and California red fir, at the higher elevations—above 6,000 feet. The higher elevations are in the Cascade Mountain Range, which makes up the eastern boundary of the survey area.

how this survey was made

Soil scientists made this survey to learn what soils are in the survey area, where they are, and how they can be used. They observed the steepness, length, and shape of slopes; the size of streams and the general pattern of drainage; the kinds of native plants or crops; and the kinds of rock. They dug many holes to study soil profiles. A profile is the sequence of natural layers, or horizons, in a soil. It extends from the surface down into the parent material, which has been changed very little by leaching or by plant roots.

The soil scientists recorded the characteristics of the profiles they studied and compared those profiles with others in nearby counties and in more distant places. They classified and named the soils according to nationwide uniform procedures. They drew the boundaries of the soils on aerial photographs. These photographs show trees, buildings, fields, roads, and other details that help in drawing boundaries accurately. The soil maps at the back of this publication were prepared from aerial photographs.

The areas shown on a soil map are called map units. Most map units are made up of one kind of soil. Some

are made up of two or more kinds. The map units in this survey area are described under "General soil map units" and "Detailed soil map units."

While a soil survey is in progress, samples of some soils are taken for laboratory measurements and for engineering tests. All soils are field tested to determine their characteristics. Interpretations of those characteristics may be modified during the survey. Data are assembled from other sources, such as test results, records, field experience, and state and local specialists. For example, data on crop yields under defined management are assembled from farm records and from field or plot experiments on the same kinds of soil.

But only part of a soil survey is done when the soils have been named, described, interpreted, and delineated on aerial photographs and when the laboratory data and other data have been assembled. The mass of detailed information then needs to be organized so that it can be used by farmers, rangeland and woodland managers, engineers, planners, developers and builders, home buyers, and others.

general soil map units

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

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

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

The 13 general map units in this survey have been grouped into four general kinds of landscape for broad interpretive purposes. Each of the broad groups and the map units in each group are described in the following pages.

map unit descriptions

Soils on flood plains, in basins, and on terraces, alluvial fans, and glacial outwash fans

Five map units are in this group. They make up about 24 percent of the survey area.

The soils in this group include nearly all of the land in Shasta and Scott Valleys. The alluvial fans are young. They consist of a sequence of narrow to broad areas of deposits of material washed from the Cascade and Klamath Mountains by rivers and streams. The older landforms occur as terraces above the streams from which they were deposited. The soils are nearly level to moderately steep. Elevation ranges from about 2,000 feet along the Shasta River to about 4,500 feet near the Cascade and Klamath Mountains.

These soils are moderately deep to very deep and are very poorly drained to somewhat excessively drained. The surface layer ranges from sand to silt loam that includes cobbles and stones in some areas.

These soils are used mainly for hay and pasture. Some areas are used as rangeland, and some are used for the production of wheat or barley. A few small areas are used for urban development.

1. Settlemeier-Diyou

Very deep, nearly level and gently sloping, poorly drained and somewhat poorly drained loams; on flood plains

This map unit is along the Scott and Shasta Rivers in the southwestern and central parts of the survey area. The soils in this unit typically have a high water table or are subject to flooding, or both, because of the high rainfall and snowmelt in winter and spring. They formed in medium textured to moderately fine textured alluvium derived from mixed rock sources. Elevation ranges from 2,000 to 4,000 feet. The average annual precipitation ranges from 15 to 18 inches, and the average annual air temperature is about 50 degrees F. The average frost-free season is about 125 days.

This unit makes up about 6 percent of the survey area. It is about 30 percent Settlemeier soils and 27 percent Diyou soils. The remaining 43 percent is components of minor extent.

Settlemeier soils are on flood plains south of Fort Jones and south of Gazelle. These soils have slopes of 0 to 5 percent. They are poorly drained. Typically, they have a stratified loam, fine sandy loam, silt loam, and sandy clay loam profile.

Diyou soils are mainly on flood plains in Scott Valley, south of Fort Jones. These soils have slopes of 0 to 2 percent. They are somewhat poorly drained. Typically, they have a stratified loam, sandy loam, sandy clay loam, and clay loam profile.

Of minor extent in this unit are the poorly drained Copsey, Odas, Pit, and Settlemeier Variant soils, the very poorly drained Esro soils, the well drained Bonnet soils, the somewhat excessively drained Deetz soils, Xerofluvents, and Riverwash. Copsey, Odas, Pit, and Settlemeier Variant soils are along small streams on the higher positions on the landscape. Esro soils are in basins. Bonnet and Deetz soils are on the higher positions on the landscape. Xerofluvents and Riverwash are variable in texture and are on the lower positions on the landscape.

Areas of this unit are mainly used for irrigated hay and pasture. A few areas are used for irrigated and nonirrigated wheat and barley. The main limitations for these uses are the seasonally high water table and the hazard of flooding. Drainage can be provided by using tile systems to intercept water from higher lying areas. Irrigation water must be applied carefully to avoid raising the water table.

This unit provides excellent habitat for wildlife such as black-tailed deer, doves, ring-necked pheasant, California quail, ducks, geese, songbirds, and birds of prey. Areas that have water at or near the surface can provide shallow water areas that can be developed for waterfowl habitat.

Permanent vegetation such as berry vines and roses left or planted along ditches and streambanks and other areas near cultivated crops provide food and cover for wildlife. Pasture management practices helpful to wildlife include delaying mowing until after the nesting season and growing plants that provide food and cover.

2. Gazelle

Moderately deep, nearly level, very poorly drained silt loams that are underlain by a hardpan; in basins

This map unit is in the central part of Shasta Valley, in an area south and east of Montague. The soils are saline-alkali. They formed in medium textured alluvium derived from mixed rock sources. Elevation is 2,500 to 3,500 feet. The average annual precipitation is about 13 inches, and the average annual air temperature is about 50 degrees F. The average frost-free season is about 125 days.

This unit makes up about 2 percent of the survey area. It is about 97 percent Gazelle soils. The remaining 3 percent is soils of minor extent.

Gazelle soils have slopes of 0 to 2 percent. Typically, they are silt loam about 25 inches thick over a calcium- and silica-cemented hardpan.

Of minor extent in this unit are the well drained Salisbury soils on terraces and older alluvial fans at the higher elevations on the landscape.

This unit is used mainly as rangeland or for irrigated pasture and hay. The main limitations for these uses are shallow soil depth, a perched water table, and a slight concentration of salts and sodium. The hardpan limits the depth to which roots can penetrate and creates a perched water table. The concentration of salts and sodium in the surface layer limits the production of plants suitable for pasture.

This map unit can provide excellent habitat for black-tailed deer, ring-necked pheasant, California quail, doves, ducks, geese, songbirds, and birds of prey. Permanent vegetation such as berry vines and roses left or planted along ditches and streambanks and other areas near cultivated crops provide food and cover for wildlife. Delaying mowing until after the nesting season and growing plants that provide food and cover are also beneficial. Shallow water areas can be developed for waterfowl habitat.

3. Salisbury-Louie

Moderately deep, nearly level to strongly sloping, well drained cobbly loams and stony loams that are underlain by a hardpan; on terraces

This map unit is in Shasta Valley, in the central part of the survey area. The soils in this unit formed in moderately coarse textured to moderately fine textured alluvium derived from mixed rock sources. Elevation ranges from 2,500 to 4,500 feet. The average annual precipitation is about 13 inches, the average annual air temperature ranges from 48 to 50 degrees F, and the average frost-free season is about 125 days.

This unit makes up about 8 percent of the survey area. It is about 42 percent Salisbury soils and 25 percent Louie soils. The remaining 33 percent is components of minor extent.

Salisbury soils are mainly on terraces north and south of Montague. These soils have slopes of 0 to 9 percent. Typically, they have a cobbly loam surface layer and a cobbly loam and gravelly clay loam subsoil that is underlain by a silica-cemented hardpan.

Louie soils are mainly on terraces south of Montague. These soils have slopes of 0 to 15 percent. Typically, they have a stony loam surface layer and a cobbly loam and cobbly sandy clay loam subsoil that is underlain by a silica-cemented hardpan.

Of minor extent in this unit are Montague, Medford, and Jenny soils and Rock outcrop. The Montague soils are clay throughout and have a lime-cemented hardpan. The Medford and Jenny soils are very deep. They are on the higher positions on stream terraces and alluvial fans. Rock outcrop is mainly extrusive igneous rock.

Areas of this unit are mainly used as rangeland or for cultivated crops. A few small areas are used for irrigated pasture and urban development.

If the hardpan is ripped, the soils in this unit are suited to most crops grown in the area. They are not well suited to nonirrigated crops because of the small amount and irregular pattern of precipitation.

This unit is moderately suited to livestock grazing. Forage production is limited by low precipitation. Brush management and stock water development are essential.

This unit can provide good habitat for rangeland wildlife. It supports habitat for black-tailed deer, ring-necked pheasant, doves, and California quail. Pasture and range management practices that are helpful to wildlife include grazing within the carrying capacity of the pasture or range, brush management, stock water development, and protection from uncontrolled burning. Permanent vegetation left or planted along fence rows, ditchbanks, and in corners of fields also provides food and cover for wildlife.

4. Stoner-Dotta

Very deep, nearly level to strongly sloping, well drained, gravelly sandy loams and loams; on alluvial fans

This map unit is along the streams and rivers that drain into Scott Valley and into the western side of Shasta Valley. The soils in this unit formed in moderately coarse textured and medium textured alluvium derived

from mixed rock sources. Elevation ranges from 2,000 to 4,000 feet. The average annual precipitation is about 18 inches, the average annual air temperature is about 50 degrees F, and the average frost-free season is about 125 days.

This unit makes up about 5 percent of the survey area. It is about 39 percent Stoner soils and 17 percent Dotta soils. The remaining 44 percent is soils of minor extent.

Stoner soils are mainly on alluvial fans in Scott Valley and along the western side of Shasta Valley. These soils have slopes of 0 to 15 percent. Typically, they have a gravelly sandy loam surface layer and a gravelly sandy loam and very gravelly loam subsoil.

Dotta soils are on alluvial fans on the western side of Shasta Valley. These soils have slopes of 0 to 9 percent. Typically, they have a loam surface layer. The subsoil is clay loam and sandy clay loam underlain by sandy clay loam.

Of minor extent in this unit are the somewhat excessively drained Atter soils and the well drained Bonnet, Duzel, Kinkel, and Kindig soils. The Atter soils have many rock fragments on the surface and throughout the profile. The Bonnet soils are on the lower positions on the landscape and have a layer of lime accumulation. The Duzel, Kinkel, and Kindig soils have steeper slopes than the Stoner and Dotta soils and are on the higher positions on the landscape.

This unit is mainly used for cultivated crops, hay, and pasture. The main cultivated crops are wheat and barley. A few small areas are used as rangeland and for urban development.

The soils in this unit have few limitations for most crops grown in the area. The hazard of erosion is the main concern where slopes are more than 2 percent. In a few areas the Stoner soils are limited by the rock fragments on the surface and in the profile.

Areas of this unit provide good habitat for upland wildlife such as ring-necked pheasant, doves, and California quail. Cropland management practices helpful to wildlife include using crop rotations that include grass-legume mixtures; delaying mowing of roadsides, areas along watercourses, and field borders until after the nesting season or harvest; leaving small areas of standing grain near good cover; planting "odd areas" to plants that provide food and cover; and planting hedgerows and windbreaks.

5. Delaney-Plutos

Moderately deep to very deep, nearly level to moderately steep, somewhat excessively drained sands and loamy sands; on glacial outwash fans

This map unit is in the southwestern part of the survey area, west of Gazelle. It is on toe slopes at the northern base of Mount Shasta. The soils in this unit formed in coarse textured alluvium derived from extrusive igneous rock and volcanic ash. Elevation ranges from 2,800 to 4,500 feet. The average annual precipitation is about 13

inches, the average annual air temperature is about 50 degrees F, and the average frost-free season is about 125 days.

This unit makes up about 3 percent of the survey area. It is about 37 percent Delaney soils and 18 percent Plutos soils. The remaining 45 percent is components of minor extent.

Delaney soils are deep or very deep. Slope is 0 to 15 percent. Typically, the surface layer and substratum are sand.

Plutos soils are moderately deep. Slope is 0 to 30 percent. Typically, the surface layer is loamy sand, and the substratum is sand over hard basalt.

Of minor extent in this unit are well drained Redola, Uhlig Variant, and Delaney Variant soils, somewhat excessively drained Deetz soils, and Rock outcrop. The Uhlig Variant soils are on uplands. Deetz soils are on the higher positions on the landscape. The Delaney Variant soils do not have bedrock or strongly contrasting material within a depth of 80 inches. Rock outcrop is mainly extrusive igneous rock.

This unit is used mainly as rangeland. A few areas are used for cultivated crops.

The soils in this unit are suited to only the most drought resistant plants because of low or very low available water capacity, low rainfall, and the high hazard of soil blowing. The production of forage on these soils is limited by the coarse soil texture, rock fragments scattered on the surface, and the predominance of shrubs and juniper in the plant community.

Areas of this unit provide excellent habitat for rangeland wildlife. Black-tailed deer, coyotes, rockchucks, quail, chukar, jackrabbits, and songbirds are the main kinds of wildlife on this unit. Water development and brush management are essential for deer and upland wildlife. Areas of Rock outcrop are used by rockchucks and cliff-nesting birds. The unit provides winter range for deer.

Soils on lower foothills of the Cascade Mountain Range

This group consists of one map unit. It makes up about 20 percent of the survey area.

The soils in this group include all of the land extending from the western edge of the Cascade foothills up to areas along the Cascade Mountain Range. The eastern boundary is determined by the elevation, shape, and aspect of the land surface, which, in turn, controls the local climate and the local development of the soils. The soils in this group are warmer and drier than the soils in the Cascade Mountains. Elevation ranges from 2,000 to 4,500 feet.

These soils are moderately deep and well drained. The surface layer ranges from stony loam to clay.

These soils are mainly used as rangeland. A few areas are used for cultivated crops.

6. Lassen-Kuck-Mary

Moderately deep, gently sloping to steep, well drained clays, clay loams, and stony loams; on foothills

This map unit is on toe slopes of the Cascade Mountain Range, in the eastern part of the survey area. The soils formed in medium textured, moderately fine textured, and fine textured material derived from extrusive igneous rock. Elevation ranges from 2,000 to 4,500 feet. The average annual precipitation is about 18 inches, the average annual air temperature is about 50 degrees F, and the average frost-free season is about 125 days.

This unit makes up about 20 percent of the survey area. It is about 32 percent Lassen soils, 20 percent Kuck soils, and 18 percent Mary soils. The remaining 30 percent is components of minor extent.

Typically, the Lassen soils have a surface layer of clay and a substratum of gravelly clay underlain by volcanic rock.

Kuck soils have a surface layer of clay loam. The subsoil is clay loam, clay, and gravelly clay loam and is underlain by weathered volcanic rock.

Mary soils have a surface layer of stony loam. The subsoil is loam, clay loam, and sandy clay loam and is underlain by weathered volcanic rock.

Of minor extent in this unit are the well drained Bogus, Deven, Hilt, Pinehurst, Terwilliger, and Pinehurst Variant soils; moderately well drained Medford soils; Lithic Haploxerolls; and Rock outcrop. The Bogus, Pinehurst, and Pinehurst Variant soils are forested and are at the higher positions on the landscape. The Hilt soils are underlain by sandstone and have a moderately coarse textured surface layer. The Deven soils and Lithic Haploxerolls are less than 20 inches deep. The Medford soils are very deep. The Terwilliger soils have a fine textured subsoil and are underlain by siltstone. The Rock outcrop consists of extrusive igneous rock.

This unit is mainly used as rangeland and for dryland pasture. A few areas are used for cultivated crops.

The soils in this unit are suitable for use as rangeland. The hazard of erosion is the main limitation. Where slopes are more than 30 percent, access by livestock is limited and overgrazing of the less sloping areas occurs. This unit is poorly suited to nonirrigated crops because of the small amount and irregular pattern of precipitation.

Cropland on this unit can support good habitat for such upland game birds as ring-necked pheasant, California quail, and dove. Cropland management practices helpful to wildlife are crop rotations that include grass and legume mixtures; use of cover crops; delaying mowing of roadsides, areas along watercourses, and field borders until after the nesting season or harvest; plowing in spring; leaving 1/8- to 1/4-acre of standing grain near good cover; planting "odd areas" to plants that provide food and cover; and planting hedgerows and windbreaks.

Range or dryland pasture conservation management practices that benefit wildlife include grazing within the

carrying capacity of the soils, developing livestock watering facilities, proper placement of salt, and providing protection from uncontrolled fire. This unit is traversed in places by perennial streams that support riparian vegetation. A few springs are on this unit. The unit provides winter range for deer.

Soils of the Cascade Mountain Range

Three map units are in this group. They make up about 12 percent of the survey area.

The soils in this group include all land extending from the eastern edge of the lower foothills to the eastern boundary of the survey area. The western boundary of this group is not sharply defined and is dependent upon aspect or the protective influence of prominent outlying hills and ridges in the lower foothills. The western boundary is approximately where the woodland begins. Elevation dominantly ranges from 2,700 to 7,500 feet.

These soils are moderately deep to very deep and are well drained or somewhat excessively drained. The surface layer ranges from loam to loamy sand and is gravelly, stony, or very stony in places.

These soils are used mainly as woodland. A few areas are used for limited grazing.

7. Pinehurst-Bogus

Deep and very deep, gently sloping to steep, well drained stony loams; on mountains

This map unit is in the Cascade Mountains, in the northeastern part of the survey area. The soils in this unit formed in medium textured, moderately fine textured, and fine textured material weathered from extrusive igneous rock. Elevation ranges from 3,500 to 6,000 feet. The average annual precipitation is about 30 inches, the average annual air temperature is about 46 degrees F, and the average frost-free season is about 90 days.

This unit makes up about 4 percent of the survey area. It is about 59 percent Pinehurst soils and 20 percent Bogus soils. The remaining 21 percent is components of minor extent.

The Pinehurst soils are deep. Slope is 2 to 50 percent. The surface layer is stony loam. The subsoil is gravelly loam, gravelly clay loam, and very stony clay loam and is underlain by weathered extrusive igneous rock.

The Bogus soils are very deep. Slope is 15 to 50 percent. The surface layer is stony loam. The subsoil is clay loam, clay, and sandy clay and is underlain by weathered tuff.

Of minor extent in this unit are Avis, Iller, Sheld, and Pinehurst Variant soils and Rock outcrop. Avis, Iller, and Sheld soils are moderately coarse textured. They are at the higher elevations in the unit. Pinehurst Variant soils are 20 to 40 inches deep over bedrock and are at the lower elevations. Rock outcrop is mainly extrusive igneous rock.

This unit is used mainly for woodland. Some areas are used for livestock grazing.

The soils in this unit are well suited to timber production. On steep slopes the hazard of erosion is a severe limitation. Conventional harvesting methods can be used, but they may be restricted from November to June because of wetness or snow. The soils are limited for road construction and logging because of large stones, boulders, and areas of Rock outcrop. Reduction of plant competition after harvesting helps to insure seedling survival.

Time and intensity of grazing by livestock and wildlife markedly influence the production and composition of the plant community. Excessive use of browse and forage by deer and livestock lowers the potential for forage production and can damage browse plants and reduce tree reproduction in reforested areas.

This unit can produce excellent habitat for wildlife species that seasonally or permanently inhabit woodland areas. Black-tailed deer, black bear, mountain lion, porcupine, raccoon, bobcat, coyote, blue grouse, gray squirrels, chipmunks, mountain quail, band-tailed pigeon, jays, doves, woodpeckers, and many songbirds use the unit. The unit is traversed by perennial streams that support riparian vegetation.

Woodland management practices that benefit wildlife are providing protection from uncontrolled fires, proper grazing use, selective cutting of woodland, leaving den trees when harvesting, piling brush near the edge of wooded areas, leaving fallen hollow logs, and clearcutting small areas of dense woodland.

8. Avis-Sheld-Iller

Very deep and deep, moderately sloping to very steep, well drained and somewhat excessively drained very stony sandy loams and stony sandy loams; on mountains

This map unit is in the Cascade Mountain Range, in the eastern part of the survey area. The soils in this unit have been influenced by volcanic ash from recent volcanic activity. Most areas of the Sheld and Iller soils are near Miller Mountain. The Avis soils are near Goosenest Mountain. The soils in this unit formed in moderately coarse textured material derived from volcanic ash deposited over areas of extrusive igneous rock. Elevation ranges dominantly from 4,500 to 7,500 feet. A small area on Goosenest Mountain is at a height of about 8,300 feet. The average annual precipitation is about 40 inches, the average annual air temperature is about 41 degrees F, and the average frost-free season is about 50 days.

This unit makes up about 5 percent of the survey area. It is about 28 percent Avis soils, 23 percent Sheld soils, and 16 percent Iller soils. The remaining 33 percent is components of minor extent.

The Avis soils are very deep and somewhat excessively drained. Slope ranges from 5 to 50 percent. The surface layer is very stony sandy loam. The underlying material is very gravelly loamy sand and very gravelly sand.

The Sheld soils are deep and well drained. Slope ranges from 9 to 65 percent. The surface layer is stony sandy loam. The subsoil is very gravelly sandy loam and very gravelly loam that is underlain by weathered andesite.

The Iller soils are very deep and well drained. Slope ranges from 9 to 50 percent. The surface layer is stony sandy loam. The subsoil is sandy loam, very stony sandy loam, and extremely stony loam.

Of minor extent in this unit are Lava flows; Odas, Oosen, Orset, and Pinehurst soils; Rock outcrop; and Snell soils. Oosen soils are somewhat excessively drained and have few rock fragments in the profile. Lava flows consists of basalt or andesite. Odas soils are poorly drained and are on flood plains. Orset soils are well drained and are on terraces of streams and in basins. Pinehurst soils are well drained and are at the lower elevations in the unit. Rock outcrop is mainly extrusive igneous rock. Snell soils are well drained and moderately deep.

This unit is used mainly as woodland.

The soils in this unit are suited to timber production. The hazard of erosion is high on the steeper slopes. Conventional harvesting methods can be used, but they may be restricted from November to June because of wetness or snow. The soils are limited for road construction and logging because of the large stones, boulders, and areas of Rock outcrop. Reduction of plant competition after harvesting helps to insure seedling survival.

Areas of this unit can produce excellent habitat for wildlife that seasonally or permanently inhabit woodland areas. Black-tailed deer, black bear, mountain lion, porcupine, raccoon, bobcat, coyote, blue grouse, gray squirrels, chipmunks, mountain quail, band-tailed pigeon, jays, doves, woodpeckers, and many songbirds use this unit. Deep snow and cold weather limit the use of the unit for wildlife habitat in winter. This unit is traversed by perennial streams that support riparian vegetation.

Woodland management practices that encourage wildlife include protection from uncontrolled fires, proper grazing use, selective cutting of woodland, leaving den trees when harvesting, piling brush near edges of woodland, leaving fallen hollow logs, and clearcutting small areas of dense woodland.

9. Ponto-Deetz-Neer

Very deep and moderately deep, nearly level to steep, somewhat excessively drained and well drained sandy loams, gravelly loamy sands, and gravelly sandy loams; on mountains

This map unit is in the Cascade Mountain Range, in the southeastern part of the survey area. The Deetz soils are on glacial outwash fans, mainly west of Mount Shasta. The Neer and Ponto soils are on hills southwest of Mount Shasta. The soils formed in coarse textured and moderately coarse textured glacial outwash derived

from extrusive igneous rock. Elevation ranges from 2,700 to 5,000 feet. The average annual precipitation is about 40 inches, the average annual air temperature is about 48 degrees F, and the average frost-free season is about 125 days.

This unit makes up about 3 percent of the survey area. It is about 25 percent Ponto soils, 24 percent Deetz soils, and 22 percent Neer soils. The remaining 29 percent is soils of minor extent.

Ponto soils are very deep and well drained. Slope ranges from 2 to 50 percent. The surface layer and subsoil are sandy loam. The substratum is stony sandy loam.

Deetz soils are very deep and somewhat excessively drained. Slope ranges from 0 to 30 percent. The surface layer is gravelly loamy sand, and the underlying material is gravelly loamy sand and very gravelly sand.

Neer soils are moderately deep and well drained. Slope ranges from 2 to 50 percent. The surface layer is gravelly sandy loam, and the subsoil is very gravelly sandy loam that is underlain by extrusive igneous rock.

Of minor extent in this unit are the well drained Asta, Boomer, Neuns, and Odas soils. Asta soils have a gravelly sandy loam surface layer and a subsoil of loam and silt loam. They are on glacial outwash terraces. Boomer soils are deep, have a gravelly clay loam subsoil, and are in the higher positions on the landscape. Neuns soils are moderately deep and have a gravelly loam surface layer and a very gravelly loam subsoil. They are on uplands. Odas soils are poorly drained and are on flood plains.

This unit is used mainly for woodland, livestock grazing, urbanization, and recreation. A few small areas are used for irrigated cropland.

Deetz soils have low to very low available water capacity, and Neer soils have very low available water capacity. These soils are suited only to the most drought resistant plants.

This unit is poorly suited to livestock grazing. The production of forage is limited by the very low to low available water capacity.

This unit can produce excellent habitat for woodland or rangeland wildlife. Black-tailed deer, black bear, porcupine, gray squirrel, band-tailed pigeon, woodpeckers, songbirds, and birds of prey are the main kinds of wildlife. In areas dominated by ponderosa pine, woodland management practices that provide food and cover for wildlife are fire protection, proper grazing use, selective cutting of small areas of woodland, leaving a few den trees, piling brush near the edge of areas of woodland, leaving fallen hollow logs, clearcutting small areas of dense woodland, and providing water for wildlife. Areas dominated by brush require brush management and the provision of water for wildlife. This unit provides winter range for deer.

Soils dominantly in the Klamath Mountain Range

Four map units are in this group. They make up about 44 percent of the survey area.

This group includes all mountainous areas west of Shasta Valley. The western and southern boundaries of the group are along the edge of the survey area. The soils in this group are nearly level to very steep. Elevation ranges from 2,000 to 6,000 feet.

These soils are very shallow to very deep and are well drained to excessively drained. The surface layer is loam to very gravelly loam.

These soils are used as woodland and rangeland.

10. Duzel-Jilson

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

This map unit is in the western part of the survey area. It is in an area between Shasta Valley and Scott Valley. The soils in this unit formed in medium textured residuum derived from metamorphic rock. Elevation ranges from 2,200 to 5,000 feet. The average annual precipitation is about 18 inches, the average annual air temperature is about 46 degrees F, and the average frost-free season is about 125 days.

This unit makes up about 17 percent of the survey area. It is about 36 percent Duzel soils and 33 percent Jilson soils. The remaining 31 percent is components of minor extent.

Duzel soils are moderately deep. Slope ranges from 5 to 50 percent. The surface layer is gravelly loam. The subsoil is gravelly loam and very gravelly clay loam and is underlain by metamorphic rock.

Jilson soils are shallow. Slope ranges from 5 to 65 percent. Typically, the surface layer is gravelly loam. The subsoil is gravelly loam and is underlain by metasedimentary rock.

Of minor extent in this unit are Facey and Marpa soils, Lithic Xerorthents, and Rock outcrop. Facey soils are deep. Marpa soils are on the higher positions on the landscape. Lithic Xerorthents are very shallow and are mainly on south-facing slopes. Rock outcrop is mainly metasedimentary rock.

This unit is used mainly as rangeland.

The Jilson soils are poorly suited to livestock grazing. The production of forage is limited by shallow rooting depth and very low available water capacity. The Duzel soils are suited to the production of forage for livestock. The hazard of erosion is the main limitation, especially where slope is more than 30 percent. Steepness of slope limits access by livestock and promotes overgrazing of the less sloping areas. Shrubs on this unit compete with grasses and forbs for soil moisture.

This unit is dissected by a few perennial streams that support riparian vegetation. A few springs are in the unit.

This unit can produce excellent habitat for rangeland wildlife. The rangeland habitat consists of both dense

and open stands of buckbrush and manzanita, which are associated with grasses and forbs and occasional trees, mainly juniper. Water for wildlife may become scarce during dry periods. Black-tailed deer, bobcat, coyote, rabbits, birds of prey, band-tailed pigeon, doves, and various songbirds are the main kinds of wildlife on this unit. The unit is also part of the winter range for the local black-tailed deer population. Range management practices that are helpful to wildlife include grazing within the carrying capacity of the soils, brush management, fertilization, livestock water development, proper placement of salt, and protection from uncontrolled fires.

11. Marpa-Kinkel-Boomer

Moderately deep to very deep, gently sloping to very steep, well drained gravelly loams and very gravelly loams; on mountains

This map unit is in the western part of the survey area. It is in an area west and north of Scott Valley. The soils in the unit formed in medium textured residuum derived from metamorphic rock. Elevation ranges from 2,000 to 5,500 feet. The average annual precipitation is about 35 inches, the average annual air temperature is about 48 degrees F, and the average frost-free season is about 125 days.

This unit makes up about 14 percent of the survey area. It is about 23 percent Marpa soils, 23 percent Kinkel soils, and 18 percent Boomer soils. The remaining 36 percent is components of minor extent.

Marpa soils are moderately deep. Slope ranges from 5 to 50 percent. The surface layer is gravelly loam. The subsoil is very gravelly sandy clay loam and is underlain by fractured metasedimentary bedrock.

Kinkel soils are very deep. Slope ranges from 2 to 50 percent. The surface layer is very gravelly loam. The subsoil is very gravelly loam and is underlain by fractured metasedimentary bedrock.

Boomer soils are deep. Slope ranges from 5 to 70 percent. The surface layer is gravelly loam. The subsoil is gravelly clay loam and gravelly sandy clay loam and is underlain by metamorphosed basic igneous rock.

Of minor extent in this unit are Asta, Atter, Chaix, Chawanakee, Dubakella, Etsel, Ipish, Kindig, and Neuns soils; Rock outcrop; and Weitchpec Variant soils. Asta soils are on terraces. Atter and Chawanakee soils are somewhat excessively drained. Chaix soils are gravelly coarse sandy loam throughout the profile. Dubakella, Ipish, and Weitchpec Variant soils formed in residuum derived from serpentinitic rock. Etsel, Kindig, and Neuns soils are on the higher positions on the landscape and generally have steeper slopes than do the Marpa, Kinkel, and Boomer soils. Rock outcrop is mainly metasedimentary rock.

This unit is used mainly as woodland. A few areas are used for grazing and recreation.

The soils in this unit are suited to timber production. The main limitations are slope and the hazard of erosion,

particularly in areas where slope is 30 percent or more. Conventional harvesting methods usually can be used, but they are restricted from November to June because of wetness or snow cover. Road construction and logging are limited by steepness of slope and the presence of large stones, boulders, and Rock outcrop. Reducing plant competition helps to insure seedling survival.

This unit has limited value for livestock grazing. The period and intensity of grazing by livestock and wildlife influence plant composition and production. Excessive use of browse and forage by deer and livestock reduces forage production. Excessive use and trampling also damage browse plants and reduce tree reproduction in reforested areas.

This unit can produce excellent habitat for wildlife species that seasonally or permanently inhabit woodland areas. The main wildlife species that use this unit include black-tailed deer, black bear, mountain lion, porcupine, raccoon, bobcat, coyote, blue grouse, mountain quail, band-tailed pigeon, gray squirrels, chipmunks, and many songbirds. Perennial streams and the associated riparian vegetation dissect the unit. Wet meadows and springs are throughout the unit. Deep snow and cold weather limit the use of the unit for wildlife habitat in winter. Critical winter range for deer is at the lower elevations in the unit.

Woodland management practices that help to develop and improve wildlife habitat include protection from uncontrolled fires, proper grazing use, selective cutting of woodland, leaving den trees when harvesting, piling brush near the edge of areas of woodland, leaving fallen hollow logs, and clearcutting small areas of dense woodland.

12. Kindig-Neuns

Deep and moderately deep, moderately steep to very steep, well drained gravelly loams; on mountains

This map unit is in the western part of the survey area. It is in an area northwest of Etna and in an area west of Hilt. The soils in this unit formed in medium textured residuum derived from metamorphic rock. They are among the steepest soils in the survey area. Elevation ranges from 2,000 to 6,000 feet. The average annual precipitation is about 35 inches, the average annual air temperature is about 48 degrees F, and the average frost-free season is about 100 days.

This unit makes up about 8 percent of the survey area. It is about 33 percent Kindig soils and 25 percent Neuns soils. The remaining 42 percent is components of minor extent.

Kindig soils are deep. The surface layer is gravelly loam. The subsoil is gravelly loam and very gravelly loam and is underlain by weathered schist.

Neuns soils are moderately deep. The surface layer is gravelly loam. The subsoil is very gravelly loam and is underlain by hard metamorphosed siltstone.

Of minor extent in this unit are Asta, Atter, Boomer, Chaix, Chawanakee, Kinkel, and Marpa soils and Rock outcrop. The Asta and the Atter soils are on glacial outwash terraces and alluvial fans. The Boomer soils are deep and have a gravelly clay loam subsoil. The Chaix soils formed in material derived from granite and have a gravelly coarse sandy loam profile. The Chawanakee soils are somewhat excessively drained, and they formed in material derived from granitic rock. The Kinkel soils are very deep and have an increase of clay in the subsoil. The Marpa soils are moderately deep and have a very gravelly sandy clay loam subsoil. Rock outcrop consists of areas where more than 90 percent of the surface is exposed metasedimentary rock.

This unit is used mainly as woodland. Some areas provide limited grazing for livestock.

This unit is suited to timber production. Where slopes are very steep, the hazard of erosion is a severe limitation. Conventional methods of harvesting timber can be used, but their use may be restricted from November to June because of wetness or snow cover. The unit is limited for road construction and logging operations because of the very steep slopes and the presence of large stones, boulders, and areas of Rock outcrop. Reducing plant competition after harvesting helps to insure seedling survival.

This unit has limited value for livestock grazing. The time and intensity of grazing by livestock and wildlife influence plant composition and production. Excessive grazing reduces forage production. It can also damage browse plants and reduce tree reproduction in reforested areas because of trampling or the acceleration of the growth of undesirable understory plants.

This unit supports several types of wildlife habitat. The main wildlife species on the unit include black-tailed deer, black bear, mountain lion, porcupine, raccoon, bobcat, coyote, blue grouse, mountain quail, band-tailed pigeon, gray squirrels, chipmunks, and many songbirds. Deep snow and cold weather limit the use of the unit for wildlife habitat in winter. Perennial streams and associated riparian vegetation dissect the unit. Narrow wet meadows and springs are throughout the unit.

Woodland management practices that help to develop and improve wildlife habitat include protection from uncontrolled fires, proper grazing use, selective cutting of woodland, leaving den trees when harvesting, piling brush near the edge of woodland, leaving fallen hollow logs, and clearcutting small areas of dense woodland.

13. Rock Outcrop-Lithic Haploxerolls-Lithic Xerorthents

Rock outcrop, and very shallow, nearly level to very steep, excessively drained soils that are variable in texture; on mountains

This map unit is mainly in the Klamath Mountains. Lithic Xerorthents are mainly in the western part of the survey area. Lithic Haploxerolls are mainly in the eastern part of the survey area and in places are at the higher elevations. The soils formed in material weathered from intrusive igneous, extrusive igneous, sedimentary, or metamorphic rock. Elevation is dominantly 2,000 to 6,000 feet. The average annual precipitation is about 30 inches, the average annual air temperature is 48 degrees F, and the average frost-free season is 100 days.

This unit makes up about 5 percent of the survey area. It is about 32 percent Rock outcrop, 23 percent Lithic Haploxerolls, and 15 percent Lithic Xerorthents. The remaining 30 percent is components of minor extent.

Rock outcrop consists of exposures of bare intrusive and extrusive igneous, sedimentary, and metamorphic rock.

Lithic Xerorthents are very shallow, excessively drained soils that formed in residual material derived from intrusive igneous, sedimentary, or metamorphic rock.

Lithic Haploxerolls are very shallow, excessively drained soils that formed in residual material derived from extrusive igneous rock.

Of minor extent in this unit are Dumps; Deetz, Duzel, and Jilson soils; and Lava flows. Dumps consists of uneven piles of waste rock from mines, quarries, and dredging operations. It is mainly gravel, cobbles, and stone-sized rock fragments. The Deetz soils are very deep gravelly loamy sand and very gravelly sand that formed in glacial outwash derived from extrusive igneous rock. The Duzel soils are moderately deep gravelly loam that formed in material derived from metamorphic rock. The Jilson soils are shallow, well drained gravelly loam derived from metasedimentary rock. Lava flows has sharp jagged surfaces, crevices, and expansion ridges of basalt or andesite that has fractured into angular blocks of cobble, stone, and boulder size.

This unit is used mainly for wildlife habitat. Black-tailed deer graze areas of the unit where vegetation is available. The major soils in this unit have very low available water capacity and very shallow depth; therefore, they are suited to only the most drought resistant plants. Sparse stands of grasses and shrubs as well as scattered juniper are mainly on the Lithic Xerorthents and Lithic Haploxerolls in the unit. These plants provide little forage or browse for livestock and wildlife. The steepness of slope and the rugged terrain also limit access by livestock and wildlife. Availability of drinking water is limited during dry seasons. Birds of prey and other cliff-nesting birds may nest in areas of Rock outcrop.

detailed soil map units

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

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

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

Each description is followed by a capability grouping and a land resource area designation (in parentheses). These are explained in the sections "Capability classes and subclasses" and "Land resource areas."

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

Soils of one series can differ in texture of the surface layer or of the underlying material. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Delaney sand, 0 to 9 percent slopes, is one of several phases in the Delaney series.

Some map units are made up of two or more major soils. These map units are called soil complexes.

A *soil complex* consists of two or more soils in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Avis-Oosen complex, 5 to 30 percent slopes, is an example.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such

differences could significantly affect use and management of the soils in the map unit. The included soils are identified in each map unit description. Some small areas of strongly contrasting soils are identified by a special symbol on the soil maps.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Riverwash is an example. Miscellaneous areas are shown on the soil maps. Some that are too small to be shown are identified by a special symbol on the soil maps.

This survey was mapped at two levels of intensity, or detail. The more detailed part is identified by narrowly defined units, and the less detailed part is identified by broadly defined units. In the narrowly defined units the soil delineation boundaries were plotted and verified at closely spaced intervals. In the broadly defined units the soil delineation boundaries were plotted and verified at greater intervals. The intensity of mapping was based on the anticipated long-term use of the survey, and the map units were designed to meet the needs for that use. On the soil map legend at the back of this survey, the broadly defined units are identified by an asterisk following the map unit name.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

map unit descriptions

101—Asta gravelly sandy loam, 5 to 15 percent slopes. This very deep, well drained soil is on glacial outwash terraces. It formed in volcanic ash deposited over glacial outwash. The native vegetation is mainly mixed conifers. Elevation is 3,000 to 5,000 feet. The average annual precipitation is about 40 inches, the average annual air temperature is about 48 degrees F, and the average frost-free period is about 125 days.

Typically, the surface is covered with a mat of undecomposed and partially decomposed needles, leaves, twigs, bark, and other organic debris about 2 inches thick. The surface layer is dark brown and brown gravelly sandy loam about 13 inches thick. The subsoil is brown and strong brown loam and strong brown silt loam

about 47 inches thick. The substratum to a depth of 71 inches or more is strong brown silt loam.

Included in this unit are small areas of Neer stony sandy loam, Ponto stony sandy loam, and a soil that is similar to this Asta soil but has slopes of more than 15 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Asta soil is moderate. Available water capacity is very high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland and for livestock grazing.

This unit is suited to the production of ponderosa pine, Douglas-fir, and white fir. It can produce about 7,310 cubic feet, or 34,200 board feet (Scribner rule), of timber per acre from a fully stocked stand of even-aged ponderosa pine trees 80 years old.

This unit has few limitations for timber production. Plant competition delays natural regeneration of trees but does not prevent the eventual development of a fully stocked, normal stand. Among the trees suitable for planting are ponderosa pine, Douglas-fir, and white fir.

The understory includes common snowberry, brackenfern, and oak.

This map unit is in capability unit IIIe-1(21), nonirrigated.

102—Asta gravelly sandy loam, 15 to 50 percent slopes. This very deep, well drained soil is on glacial outwash terraces. It formed in volcanic ash deposited over glacial outwash. The native vegetation is mainly mixed conifers. Elevation is 3,000 to 5,000 feet. The average annual precipitation is about 40 inches, the average annual air temperature is about 48 degrees F, and the average frost-free period is about 125 days.

Typically, the surface is covered with a mat of undecomposed and partially decomposed needles, leaves, twigs, bark, and other organic debris about 2 inches thick. The surface layer is dark brown and brown gravelly sandy loam about 13 inches thick. The subsoil is brown and strong brown loam and strong brown silt loam about 47 inches thick. The substratum to a depth of 71 inches or more is strong brown silt loam.

Included in this unit are small areas of Neer stony sandy loam, Ponto stony sandy loam, and a soil that is similar to this Asta soil but has slopes of more than 50 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Asta soil is moderate. Available water capacity is very high. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

This unit is used as woodland.

This unit is suited to the production of ponderosa pine, Douglas-fir, and white fir. It can produce about 7,310 cubic feet, or 34,200 board feet (Scribner rule), of timber

per acre from a fully stocked stand of even-aged ponderosa pine trees 80 years old.

The main concerns in producing and harvesting timber are the hazards of erosion and plant competition. Conventional methods of harvesting trees can be used in the more gently sloping areas but are difficult to use in the steeper areas. Proper design of road drainage systems and care in the placement of culverts help to control erosion. Spoil from excavations is subject to rill and gully erosion and to sloughing. Reforestation must be carefully managed to reduce competition from undesirable understory plants. Among the trees that are suitable for planting are ponderosa pine, Douglas-fir, and white fir.

The understory includes common snowberry, brackenfern, and oak.

This map unit is in capability subclass VIe(21), nonirrigated.

103—Asta cobbly sandy loam, 15 to 50 percent slopes. This very deep, well drained soil is on glacial outwash terraces. It formed in volcanic ash deposited over glacial outwash. The native vegetation is mainly mixed conifers. Elevation is 3,000 to 5,000 feet. The average annual precipitation is about 40 inches, the average annual air temperature is about 48 degrees F, and the average frost-free period is about 125 days.

Typically, the surface is covered with a mat of undecomposed and partially decomposed needles, leaves, twigs, bark, and other organic debris about 2 inches thick. The surface layer is dark brown and brown cobbly sandy loam about 13 inches thick. The upper 21 inches of the subsoil is brown and strong brown cobbly loam. The lower 26 inches is strong brown cobbly silt loam. The substratum to a depth of 71 inches or more is strong brown cobbly silt loam.

Included in this unit are small areas of Neer stony sandy loam, Ponto stony sandy loam, and a soil that is similar to this Asta soil but has slopes of more than 50 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Asta soil is moderate. Available water capacity is very high. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

This unit is used as woodland.

This unit is suited to the production of ponderosa pine, Douglas-fir, and white fir. It can produce about 7,310 cubic feet, or 34,200 board feet (Scribner rule), of timber per acre from a fully stocked stand of even-aged ponderosa pine trees 80 years old.

The main concerns in producing and harvesting timber are the hazards of erosion and plant competition. Conventional methods of harvesting trees can be used in the more gently sloping areas but are difficult to use in the steeper areas. Proper design of road drainage systems and care in the placement of culverts help to

control erosion. Spoil from excavations is subject to rill and gully erosion and to sloughing. Reforestation must be carefully managed to reduce competition from undesirable understory plants. Among the trees that are suitable for planting are ponderosa pine, Douglas-fir, and white fir.

The understory includes common snowberry, brackenfern, and oak.

This map unit is in capability subclass VIe(21), nonirrigated.

104—Atter very gravelly sandy loam, 0 to 5 percent slopes. This very deep, somewhat excessively drained soil is on alluvial fans. It formed in mixed alluvium. The native vegetation is mainly mixed conifers, shrubs, perennial grasses, and forbs. Elevation is 2,800 to 3,200 feet. The average annual precipitation is about 18 inches, the average annual air temperature is about 50 degrees F, and the average frost-free period is about 125 days.

Typically, the surface layer is dark grayish brown and pale brown very gravelly sandy loam about 18 inches thick. The underlying material to a depth of 60 inches or more is light brownish gray and pale brown very cobbly loamy sand and very cobbly sand.

Included in this unit are small areas of Stoner gravelly sandy loam and Riverwash in intermittent drainageways. Included areas make up about 10 percent of the total acreage.

Permeability of this Atter soil is very rapid. Available water capacity is low or very low. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland and for livestock grazing.

This unit is suited to the production of ponderosa pine, Jeffrey pine, and Douglas-fir. It can produce about 1,650 cubic feet, or 7,000 board feet (Scribner rule), of timber per acre from a fully stocked stand of even-aged ponderosa pine trees 80 years old.

The main concerns in producing and harvesting timber are seedling mortality and plant competition. The low available water capacity generally influences seedling survival in areas where understory plants are numerous. Reforestation must be carefully managed to reduce competition from undesirable understory plants. Among the trees that are suitable for planting are ponderosa pine and Douglas-fir.

When the density of the forest canopy is less than about 40 percent, this unit produces grazable understory. The understory includes Idaho fescue, California brome, and antelope bitterbrush.

This unit is in capability unit IVs-4(21), nonirrigated.

105—Atter very cobbly sandy loam, 0 to 5 percent slopes. This very deep, somewhat excessively drained soil is on alluvial fans. It formed in mixed alluvium. The

native vegetation is mainly mixed conifers, shrubs, perennial grasses, and forbs. Elevation is 2,800 to 3,200 feet. The average annual precipitation is about 18 inches, the average annual air temperature is about 50 degrees F, and the average frost-free period is about 125 days.

Typically, the surface layer is dark grayish brown and pale brown very cobbly sandy loam about 18 inches thick. The underlying material to a depth of 60 inches or more is light brownish gray and pale brown very cobbly loamy sand and very cobbly sand. A few cobbles are on the surface in most places.

Included in this unit are small areas of Stoner gravelly sandy loam and a soil that is similar to this Atter soil but has slopes of 5 to 50 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Atter soil is very rapid. Available water capacity is very low to low. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland and for livestock grazing.

This unit is suited to the production of ponderosa pine, Jeffrey pine, and Douglas-fir. It can produce about 1,650 cubic feet, or 7,000 board feet (Scribner rule), of timber per acre from a fully stocked stand of even-aged ponderosa pine trees 80 years old.

The main concerns in producing and harvesting timber are seedling mortality and plant competition. The very low to low available water capacity generally influences seedling survival in areas where understory plants are numerous. Reforestation must be carefully managed to reduce competition from undesirable understory plants. Among the trees that are suitable for planting are ponderosa pine and Douglas-fir.

If the density of the forest canopy is less than about 40 percent, this unit produces grazable understory. The understory includes Idaho fescue, California brome, and antelope bitterbrush.

This unit is in capability unit IVs-4(21), nonirrigated.

106—Atter very bouldery loamy fine sand, 5 to 30 percent slopes. This very deep, somewhat excessively drained soil is on alluvial fans. It formed in mixed alluvium. The native vegetation is mainly mixed conifers, shrubs, perennial grasses, and forbs. Elevation is 3,000 to 5,000 feet. The average annual precipitation is about 18 inches, the average annual air temperature is about 50 degrees F, and the average frost-free period is about 125 days.

Typically, many boulders are on the surface. The surface layer is dark grayish brown and pale brown very bouldery loamy fine sand about 23 inches thick. The underlying material to a depth of 60 inches or more is light brownish gray and pale brown very bouldery loamy sand and very bouldery sand.

Included in this unit are small areas of Stoner gravelly sandy loam and a soil that is similar to this Atter soil but has slopes of 30 to 50 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Atter soil is very rapid. Available water capacity is very low. Effective rooting depth is 60 inches or more. Runoff is medium to rapid, and the hazard of water erosion is moderate to high.

This unit is used as woodland and for livestock grazing.

This unit is poorly suited to woodland. It can produce about 1,650 cubic feet, or 7,000 board feet (Scribner rule), of timber per acre from a fully stocked stand of even-aged ponderosa pine trees 80 years old.

The main concerns in producing and harvesting timber are seedling mortality, equipment limitations, and the hazard of erosion. The very low available water capacity generally influences seedling survival in areas where understory plants are numerous. Boulders on the surface can interfere with felling, yarding, and other operations involving the use of equipment. Proper design of road drainage systems and care in the placement of culverts help to control erosion. Spoil from excavations is subject to rill and gully erosion and to sloughing.

Reforestation is limited to hand planting. Among the trees that are suitable for planting are ponderosa pine and Douglas-fir.

When the density of the forest canopy is less than about 40 percent, this unit produces grazable understory. The understory includes Idaho fescue, California brome, and antelope bitterbrush.

This map unit is in capability subclass VIIs(21), nonirrigated.

107—Avis-Oosen complex, 5 to 30 percent slopes.

This map unit is on mountains. The native vegetation is mainly mixed conifers. Elevation is 5,000 to 7,000 feet. The average annual precipitation is about 40 inches, the average annual air temperature is about 41 degrees F, and the average frost-free period is about 50 days.

This unit is 45 percent Avis very stony sandy loam and 25 percent Oosen loamy sand. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of a soil that is similar to the Oosen soil but is underlain by sand at a depth of 40 to 60 inches. Also included are small areas of Lava flows and Rock outcrop. Included areas make up about 30 percent of the total acreage.

The Avis soil is very deep and somewhat excessively drained. It formed in volcanic ash. Typically, the surface is covered with a mat of undecomposed and partially decomposed needles, leaves, twigs, bark, and other organic debris about 3 inches thick. The surface layer is yellowish brown very stony sandy loam about 13 inches thick. The underlying material to a depth of 72 inches or more is yellowish brown and light yellowish brown very

gravelly loamy sand and very gravelly sand. Many stones are on the surface in most places.

Permeability of the Avis soil is rapid. Available water capacity is very low to low. Effective rooting depth is 60 inches or more. Runoff is medium to rapid, and the hazard of water erosion is moderate to high.

The Oosen soil is very deep and somewhat excessively drained. It formed in volcanic ash. Typically, the surface is covered with a mat of undecomposed and partially decomposed needles, leaves, twigs, bark, and other organic debris about 1/4 inch thick. Typically, the surface layer is dark brown and light yellowish brown loamy sand about 12 inches thick. The upper 16 inches of the underlying material is yellowish brown loamy sand. The lower part to a depth of 72 inches or more is dark brown sand.

Permeability of the Oosen soil is rapid. Available water capacity is low to moderate. Effective rooting depth is 60 inches or more. Runoff is medium to rapid, and the hazard of water erosion is moderate to high.

This unit is used as woodland.

This unit is suited to the production of ponderosa pine, white fir, and Douglas-fir. The Avis soil can produce about 1,970 cubic feet, or 8,560 board feet (Scribner rule), of timber per acre from a fully stocked stand of even-aged ponderosa pine trees 80 years old. The Oosen soil can produce about 6,250 cubic feet, or 29,280 board feet (Scribner rule), of timber per acre from a fully stocked stand of even-aged ponderosa pine trees 80 years old.

The main concerns in producing and harvesting timber on this unit are seedling mortality and plant competition. Stones on the surface of the Avis soil can interfere with felling, yarding, and other operations involving the use of equipment.

The low to very low available water capacity generally influences seedling survival in areas where understory plants are numerous. Reforestation must be carefully managed to reduce competition from undesirable understory plants. Among the trees that are suitable for planting are white fir, California red fir, and, on the Avis soil, ponderosa pine.

The understory includes manzanita, snowbrush, ceanothus, and Sierra chinquapin.

This map unit is in capability subclass VIIs(22), nonirrigated.

108—Avis-Oosen complex, 30 to 50 percent slopes.

This map unit is on mountains. The native vegetation is mainly mixed conifers. Elevation is 5,000 to 7,000 feet. The average annual precipitation is about 40 inches, the average annual air temperature is about 41 degrees F, and the average frost-free period is about 50 days.

This unit is 60 percent Avis very stony sandy loam and 25 percent Oosen loamy sand. The components of this

unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of a soil that is similar to this Oosen soil but is underlain by sand at a depth of 40 to 60 inches. Also included are small areas of Lava flows and Rock outcrop. Included areas make up about 15 percent of the total acreage.

The Avis soil is very deep and somewhat excessively drained. It formed in volcanic ash. Typically, the surface is covered with a mat of undecomposed and partially decomposed needles, leaves, twigs, bark, and other organic debris about 3 inches thick. The surface layer is yellowish brown very stony sandy loam about 13 inches thick. The underlying material to a depth of 72 inches or more is yellowish brown and light yellowish brown very gravelly loamy sand and very gravelly sand. Many stones are on the surface in most places.

Permeability of the Avis soil is rapid. Available water capacity is very low to low. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

The Oosen soil is very deep and somewhat excessively drained. It formed in volcanic ash. Typically, the surface is covered with a mat of undecomposed and partially decomposed needles, leaves, twigs, bark, and other organic debris about 1/4 inch thick. The surface layer is dark brown and light yellowish brown loamy sand about 12 inches thick. The upper 16 inches of the underlying material is yellowish brown loamy sand. The lower part to a depth of 72 inches or more is dark brown sand.

Permeability of the Oosen soil is rapid. Available water capacity is low to moderate. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

This unit is used as woodland.

This unit is suited to the production of ponderosa pine, white fir, and Douglas-fir. The Avis soil can produce about 1,970 cubic feet, or 8,560 board feet (Scribner rule), of timber per acre from a fully stocked stand of even-aged ponderosa pine trees 80 years old. The Oosen soil can produce about 6,250 cubic feet, or 29,280 board feet (Scribner rule), of timber per acre from a fully stocked stand of even-aged ponderosa pine trees 80 years old.

The main concerns in producing and harvesting timber on this unit are slope, the hazard of erosion, seedling mortality, and plant competition. Stones on the surface of the Avis soil can interfere with felling, yarding, and other operations involving the use of equipment. Conventional methods of harvest are difficult to use because of the steepness of slope. Proper design of road drainage systems and care in the placement of culverts help to control erosion. Spoil from excavations is subject to rill and gully erosion and to sloughing.

The low to very low available water capacity generally influences seedling survival in areas where understory

plants are numerous. Reforestation must be carefully managed to reduce competition from undesirable understory plants. Among the trees that are suitable for planting are white fir, California red fir, and, on the Avis soil, ponderosa pine.

The understory includes manzanita, snowbrush, ceanothus, and Sierra chinquapin.

This map unit is in capability subclass VII(22), nonirrigated.

109—Avis-Lava flows complex, 5 to 30 percent slopes. This map unit is on mountains. The native vegetation is mainly mixed conifers. Elevation is 5,000 to 7,000 feet. The average annual precipitation is about 40 inches, the average annual air temperature is about 41 degrees F, and the average frost-free period is about 50 days.

This unit is 60 percent Avis very stony sandy loam and 30 percent Lava flows. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Oosen loamy sand and a soil that is similar to the Avis soil but has slopes of 30 to 50 percent. Included areas make up about 10 percent of the total acreage.

The Avis soil is very deep and somewhat excessively drained. It formed in volcanic ash. Typically, the surface is covered with a mat of undecomposed and partially decomposed needles, leaves, twigs, bark, and other organic debris about 3 inches thick. The surface layer is yellowish brown very stony sandy loam about 13 inches thick. The underlying material to a depth of 75 inches or more is yellowish brown and light yellowish brown very gravelly loamy sand and very gravelly sand. Many stones are on the surface in most places.

Permeability of the Avis soil is rapid. Available water capacity is very low to low. Effective rooting depth is 60 inches or more. Runoff is medium to rapid, and the hazard of water erosion is moderate to high.

Lava flows consists of areas covered by jagged lava surfaces and angular blocks with crevices. Soil material is in a few cracks and sheltered pockets.

This unit is used as woodland.

This unit is poorly suited to the production of ponderosa pine, white fir, and Douglas-fir. The Avis soil can produce about 1,970 cubic feet, or 8,560 board feet (Scribner rule), of timber per acre from a fully stocked stand of even-aged ponderosa pine trees 80 years old.

The main concerns in producing and harvesting timber are equipment limitations, seedling mortality, and plant competition. Stones on the surface can interfere with felling, yarding, and other operations involving the use of equipment. The very low to low available water capacity generally influences seedling survival in areas where understory plants are numerous. Reforestation must be carefully managed to reduce competition from undesirable understory plants. Among the trees that are

suitable for planting are white fir, California red fir, and ponderosa pine.

The understory includes bearberry manzanita, snowbrush ceanothus, and Sierra chinquapin.

This map unit is in capability subclass VII(22), nonirrigated.

110—Bogus stony loam, 15 to 50 percent slopes.

This very deep, well drained soil is on mountains. It formed in residuum derived dominantly from tuff. The native vegetation is mainly mixed conifers, shrubs, perennial grasses, and forbs. Elevation is 3,500 to 5,500 feet. The average annual precipitation is about 30 inches, the average annual air temperature is about 46 degrees F, and the average frost-free period is about 90 days.

Typically, the surface is covered with a mat of undecomposed and partially decomposed needles, leaves, twigs, bark, and other organic debris about 1 inch thick. The surface layer is very dark grayish brown stony loam 3 inches thick. The next layer is dark grayish brown and grayish brown clay loam about 17 inches thick. The subsoil is yellowish brown clay loam, clay, and sandy clay about 42 inches thick. Weathered tuff is at a depth of 62 inches or more. A few stones are on the surface in most places.

Included in this unit are small areas of Kuck clay loam, 9 to 15 percent slopes; Rock outcrop; and a soil that is similar to this Bogus soil but is underlain by tuff at a depth of 20 to 60 inches. Included areas make up about 25 percent of the total acreage.

Permeability of this Bogus soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

This unit is used as woodland and for livestock grazing.

This unit is suited to the production of Jeffrey pine, ponderosa pine, and Douglas-fir. It can produce about 5,540 cubic feet, or 26,000 board feet (Scribner rule), of timber per acre from a fully stocked stand of even-aged Jeffrey pine trees 80 years old.

The main concerns in producing and harvesting timber are the hazard of erosion, equipment limitations, and plant competition. Spoil from excavations is subject to rill and gully erosion and to sloughing. Proper design of road drainage systems and care in the placement of culverts help to control erosion. Because the clayey soil is sticky when wet, most planting and harvesting equipment can be used only during dry periods. Conventional methods of harvesting trees can be used. Reforestation must be carefully managed to reduce competition from undesirable understory plants. Among the trees that are suitable for planting are Douglas-fir and Jeffrey pine.

When the density of the forest canopy is less than about 40 percent, the soil in this unit produces grazable

understory. The understory includes needlegrass, fescue, lupine, and roundleaf snowberry. Livestock grazing should be managed to protect the soil from excessive erosion.

This map unit is in capability subclass VIe(22), nonirrigated.

111—Bogus very stony loam, 15 to 50 percent slopes. This very deep, well drained soil is on mountains. It formed in residuum derived dominantly from tuff. The native vegetation is mainly mixed conifers, shrubs, perennial grasses, and forbs. Elevation is 3,500 to 5,500 feet. The average annual precipitation is about 30 inches, the average annual air temperature is about 46 degrees F, and the average frost-free period is about 90 days.

Typically, the surface is covered with a mat of undecomposed and partially decomposed needles, leaves, twigs, bark, and other organic debris about 1 inch thick. The surface layer is very dark grayish brown very stony loam 3 inches thick. The next layer is dark grayish brown and grayish brown clay loam about 17 inches thick. The subsoil is yellowish brown clay loam, clay, and sandy clay about 42 inches thick. Many stones are on the surface in most places.

Included in this unit are small areas of Kuck clay loam, 9 to 15 percent slopes; a soil that is similar to this Bogus soil but is underlain by tuff at a depth of 20 to 60 inches; and Rock outcrop. Included areas make up about 25 percent of the total acreage.

Permeability of this Bogus soil is slow. Available water capacity is high. Effective rooting depth is 60 to 80 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used as woodland and for livestock grazing.

This unit is suited to the production of Jeffrey pine, ponderosa pine, and Douglas-fir. It can produce about 5,540 cubic feet, or 26,000 board feet (Scribner rule), of timber per acre from a fully stocked stand of even-aged Jeffrey pine trees 80 years old.

The main concerns in producing and harvesting timber are the hazard of erosion, stones on the surface, equipment limitations, and plant competition. Spoil from excavations is subject to rill and gully erosion and to sloughing. Proper design of road drainage systems and care in the placement of culverts help to control erosion. Because the surface layer is sticky when wet, most planting and harvesting equipment can be used only during dry periods. Stones on the surface interfere with felling, yarding, and other operations involving the use of equipment. Reforestation is limited to hand planting. Among the trees that are suitable for planting are Douglas-fir and Jeffrey pine.

When the density of the forest canopy is less than about 40 percent, the soil in this unit produces grazable understory. The understory includes needlegrass, fescue,

lupine, and snowberry. Livestock grazing should be managed to protect the soil from excessive erosion.

This map unit is in capability subclass VII(22), nonirrigated.

112—Bonnet loam, 0 to 2 percent slopes. This very deep, well drained soil is on alluvial fans. It formed in mixed alluvium. The vegetation in areas not cultivated is mainly perennial grasses, shrubs, forbs, and scattered oak trees. Elevation is 2,500 to 3,500 feet. The average annual precipitation is about 18 inches, the average annual air temperature is about 50 degrees F, and the average frost-free period is about 125 days.

Typically, the surface layer is grayish brown loam about 14 inches thick. The upper part of the underlying material is pale brown and grayish brown very gravelly loam and very gravelly sandy loam 32 inches thick. The lower part to a depth of 61 inches or more is pale brown extremely gravelly loamy sand. The underlying material is calcareous. In some areas the surface layer is gravelly loam or gravelly sandy loam.

Included in this unit are small areas of Dotta loam, Stoner gravelly sandy loam, Xerofluvents on flood plains, and Riverwash. Included areas make up about 10 percent of the total acreage.

Permeability of this Bonnet soil is moderately rapid to a depth of 46 inches and rapid below this depth. Available water capacity is low. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for cultivated crops, hay and pasture, rangeland, and homesite development. The main irrigated crops are wheat, barley, and potatoes. Nonirrigated wheat and barley are also grown.

This unit is suited to the crops commonly grown in the area. It is limited mainly by droughtiness. Because precipitation is not sufficient for annual cropping, a cropping system that includes summer fallow is most suitable. Because the water intake rate of the soil is rapid, sprinkler irrigation is best suited. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crop needs. Because the soil is droughty, applications of irrigation water should be light and frequent. Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth.

This unit is suited to irrigated hay and pasture. Fertilizer is needed for optimum growth of grasses and legumes. Using management that maintains optimum vigor and quality of forage plants is a good practice.

This unit is suited to use as rangeland. It has few limitations for this use. The soil in this unit responds well to fertilizer, to range seeding, and to proper grazing use. The potential plant community on this unit includes Idaho fescue, bluebunch wheatgrass, and buckbrush.

This unit is suited to homesite development. The main limitation for septic tank absorption fields is that the soil is a poor filter for effluent. If the density of housing is moderate to high, community sewage systems are needed to prevent contamination of water supplies as a result of seepage.

Removal of pebbles and cobbles in disturbed areas is required for best results when landscaping, particularly in areas used for lawns. In summer, irrigation is required for lawn grasses, shrubs, vines, shade trees, and ornamental trees.

This map unit is in capability unit III(0)(21), irrigated and nonirrigated.

113—Bonnet gravelly loam, 0 to 2 percent slopes.

This very deep, well drained soil is on alluvial fans. It formed in mixed alluvium. The vegetation in areas not cultivated is mainly perennial grasses, shrubs, forbs, and scattered oak trees. Elevation is 2,500 to 3,500 feet. The average annual precipitation is about 18 inches, the average annual air temperature is about 50 degrees F, and the average frost-free period is about 125 days.

Typically, the surface layer is grayish brown gravelly loam about 14 inches thick. The upper part of the underlying material is pale brown and grayish brown very gravelly loam and very gravelly sandy loam 34 inches thick. The lower part to a depth of 61 inches or more is pale brown extremely gravelly loamy sand. The underlying material is calcareous.

Included in this unit are small areas of Dotta loam, Stoner gravelly sandy loam, and Riverwash. Included areas make up about 15 percent of the total acreage.

Permeability of this Bonnet soil is moderately rapid to a depth of 46 inches and rapid below this depth. Available water capacity is very low or low. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for cultivated crops, hay and pasture, rangeland, and homesite development. The main irrigated crops are wheat, barley, and potatoes. Nonirrigated wheat and barley are also grown.

This unit is suited to the crops commonly grown in the area. It is limited mainly by droughtiness and the gravelly texture of the surface layer. Because precipitation is not sufficient for annual cropping, a cropping system that includes summer fallow is most suitable. Gravel in the surface layer causes rapid wear of equipment used for tillage.

Because the water intake rate is rapid, sprinkler irrigation is best suited to the soil in this unit. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crop needs. Because the soil is droughty, applications of irrigation water should be light and frequent.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth.

This unit is suited to irrigated hay and pasture. Fertilizer is needed for optimum growth of grasses and legumes. Using management that maintains optimum vigor and quality of forage plants is a good practice.

This unit is suited to use as rangeland. It has few limitations for this use. The soil responds well to fertilizer, to range seeding, and to proper grazing use. The potential plant community on this unit includes Idaho fescue, beardless wheatgrass, bottlebrush squirreltail, and western juniper.

This unit is suited to homesite development. The main limitations are the gravelly texture of the surface layer and the extremely gravelly substratum, which is a poor filter for effluent from septic tank absorption fields. If the density of housing is moderate to high, community sewage systems are needed to prevent contamination of water supplies as a result of the rapid permeability in the lower part of the substratum.

Removal of pebbles and cobbles in disturbed areas is required for best results when landscaping, particularly in areas used for lawns. In summer, irrigation is required for lawn grasses, shrubs, vines, shade trees, and ornamental trees.

This map unit is in capability unit IIIs-4(21), irrigated and nonirrigated.

114—Bonnet gravelly loam, 2 to 5 percent slopes.

This very deep, well drained soil is on alluvial fans. It formed in mixed alluvium. The vegetation in areas not cultivated is mainly perennial grasses, shrubs, forbs, and scattered oak trees. Elevation is 2,500 to 3,500 feet. The average annual precipitation is about 18 inches, the average annual air temperature is about 50 degrees F, and the average frost-free period is about 125 days.

Typically, the surface layer is grayish brown gravelly loam about 14 inches thick. The upper part of the underlying material is pale brown and grayish brown very gravelly loam and very gravelly sandy loam 34 inches thick. The lower part to a depth of 61 inches or more is pale brown extremely gravelly loamy sand. The underlying material is calcareous. In some areas the surface layer is loam.

Included in this unit are small areas of Dotta loam, Stoner gravelly sandy loam, and Riverwash. Included areas make up about 20 percent of the total acreage.

Permeability of this Bonnet soil is moderately rapid to a depth of 46 inches and rapid below this depth. Available water capacity is very low or low. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for cultivated crops, hay and pasture, rangeland, and homesite development. The main irrigated crops are wheat, barley, and potatoes. Nonirrigated wheat and barley are also grown.

This unit is suited to crops commonly grown in the area. It is limited mainly by droughtiness and gravelly texture. Because precipitation is not sufficient for annual cropping, a cropping system that includes small grain and summer fallow is most suitable. Gravel in the surface layer causes rapid wear of equipment used for tillage.

Because the water intake rate is rapid, sprinkler irrigation is best suited to the soil in this unit. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crop needs.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth.

This unit is suited to irrigated hay and pasture. Fertilizer is needed for optimum growth of grasses and legumes. Using management that maintains optimum vigor and quality of forage plants is a good practice.

This unit is suited to use as rangeland. It has few limitations. The soil in this unit responds well to fertilizer, to range seeding, and to proper grazing use. The potential plant community on the unit includes Idaho fescue, bluebunch wheatgrass, antelope bitterbrush, and western juniper.

This unit is suited to homesite development. The main limitations are the gravelly surface layer and the rapid permeability and high content of gravel in the lower part of the substratum. If the density of housing is moderate to high, community sewage systems are needed to prevent contamination of water supplies as a result of the rapid permeability in the lower part of the substratum.

Removal of pebbles and cobbles in disturbed areas is required for best results when landscaping, particularly in areas used for lawns. In summer, irrigation is required for lawn grasses, shrubs, vines, shade trees, and ornamental trees.

This map unit is in capability unit IIIe-4(21), irrigated and nonirrigated.

115—Boomer loam, cool, 5 to 30 percent slopes.

This deep, well drained soil is on mountains. It formed in residuum derived dominantly from metamorphosed rock. The native vegetation is mainly mixed conifers, oaks, shrubs, perennial grasses, and forbs. Elevation is 2,500 to 5,000 feet. The average annual precipitation is about 35 inches, the average annual air temperature is about 48 degrees F, and the average frost-free period is about 125 days.

Typically, the surface is covered with a mat of undecomposed and partially decomposed needles, leaves, twigs, bark, and other organic debris about 1 inch thick. The surface layer is brown loam about 10

inches thick. The upper 30 inches of the subsoil is yellowish red clay loam. The lower 13 inches is yellowish red sandy clay loam. Weathered rock is at a depth of 53 inches.

Included in this unit are small areas of Kimbel very gravelly loam, Neuns gravelly loam, and Rock outcrop. Included areas make up about 20 percent of the total acreage.

Permeability of this Boomer soil is moderately rapid. Available water capacity is moderate to high. Effective rooting depth is 40 to 60 inches. Runoff is medium to rapid, and the hazard of water erosion is moderate to high.

This unit is used as woodland and for livestock grazing.

This unit is suited to the production of ponderosa pine, Douglas-fir, and incense-cedar. It can produce about 4,110 cubic feet, or 18,500 board feet (Scribner rule), of timber per acre from a fully stocked stand of even-aged ponderosa pine trees 80 years old.

The main concerns in producing and harvesting timber are plant competition and the hazard of erosion.

Reforestation must be carefully managed to reduce competition from undesirable understory plants. Among the trees that are suitable for planting are ponderosa pine and Douglas-fir.

When the density of the forest canopy is less than about 40 percent, this unit produces grazable understory. The understory includes mountain brome, manzanita, buckbrush, bluegrass, and blue wildrye. Livestock grazing should be managed to protect the unit from excessive erosion.

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

116—Boomer, cool-Neuns complex, 30 to 70 percent slopes. This map unit is on mountains. The native vegetation is mainly mixed conifers, oaks, shrubs, perennial grasses, and forbs. Elevation is 2,500 to 5,000 feet. The average annual precipitation is about 35 inches, the average annual air temperature is about 48 degrees F, and the average frost-free period is about 125 days.

This unit is 40 percent Boomer loam, cool, and 30 percent Neuns gravelly loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Kinkel very gravelly loam that has slopes of as much as 70 percent, Rock outcrop, and Riverwash, which is in intermittent drainageways. Included areas make up about 30 percent of the total acreage.

The Boomer soil is deep and well drained. It formed in residuum derived dominantly from metamorphosed rock. Typically, the surface is covered with a mat of undecomposed and partially decomposed needles, leaves, twigs, bark, and other organic debris about 1 inch thick. The surface layer is brown loam about 10

inches thick. The upper 30 inches of the subsoil is yellowish red clay loam. The lower 13 inches is yellowish red sandy clay loam. Weathered rock is at a depth of 53 inches.

Permeability of the Boomer soil is moderately slow. Available water capacity is moderate to high. Effective rooting depth is 40 to 60 inches. Runoff is rapid to very rapid, and the hazard of water erosion is high to very high.

The Neuns soil is moderately deep and well drained. It formed in residuum derived dominantly from metamorphosed rock. Typically, the surface is covered with a mat of undecomposed and partially decomposed needles, leaves, twigs, bark, and other organic debris about 2 inches thick. The surface layer is dark brown and light yellowish brown gravelly loam about 8 inches thick. The subsoil is yellowish brown and pale brown very gravelly loam about 27 inches thick. Fractured bedrock is at a depth of 35 inches.

Permeability of the Neuns soil is moderate. Available water capacity is very low to low. Effective rooting depth is 20 to 40 inches. Runoff is rapid to very rapid, and the hazard of water erosion is high to very high.

This unit is used as woodland and for livestock grazing.

This unit is suited to the production of ponderosa pine and Douglas-fir. The Boomer soil can produce about 4,110 cubic feet, or 18,500 board feet (Scribner rule), of timber per acre from a fully stocked stand of even-aged ponderosa pine trees 80 years old. The Neuns soil can produce about 8,425 cubic feet, or 27,750 board feet (Scribner rule), of timber per acre from a fully stocked stand of even-aged Douglas-fir trees 80 years old.

The main concerns in producing and harvesting timber are the hazard of erosion, slope, equipment limitations, and plant competition. The very low to low available water capacity of the Neuns soil generally influences seedling survival. Spoil from excavations is subject to rill and gully erosion and to sloughing. Proper design of road drainage systems and care in the placement of culverts help to control erosion.

Conventional methods of harvest are difficult to use because of the steepness of slope. The high-lead logging method is more efficient than most other methods and is less damaging to the soil surface.

Reforestation must be carefully managed to reduce competition from undesirable understory plants. Among the trees that are suitable for planting are ponderosa pine and Douglas-fir.

When the density of the forest canopy is less than about 40 percent, this unit produces grazable understory. The understory includes manzanita, squawcarpet, bluegrass, and blue wildrye. Livestock grazing should be managed to protect the unit from excessive erosion.

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

117—Boomer Variant sandy loam, 30 to 50 percent slopes. This very deep, well drained soil is on mountains. It formed in residuum derived dominantly from sandstone. The native vegetation is mainly mixed conifers, shrubs, perennial grasses, and forbs. Elevation is 2,500 to 5,000 feet. The average annual precipitation is about 35 inches, the average annual air temperature is about 48 degrees F, and the average frost-free period is about 125 days.

Typically, the surface is covered with a mat of undecomposed and partially decomposed needles, leaves, twigs, bark, and other organic debris about 1 inch thick. The surface layer is brown and light brown sandy loam about 10 inches thick. The upper 15 inches of the subsoil is light yellowish brown sandy loam. The lower 45 inches is yellowish brown sandy clay loam, loam, and sandy loam. Weathered bedrock is at a depth of 70 inches.

Included in this unit are small areas of Neuns gravelly loam and soils that are similar to this Boomer Variant soil but have less than 18 percent clay in the subsoil, are underlain by hard sandstone at a depth of 20 to 40 inches, or have slopes of as little as 15 percent. Included areas make up about 20 percent of the total acreage.

Permeability of this Boomer Variant soil is moderate. Available water capacity is moderate to high. Effective rooting depth is 60 to 80 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used as woodland and for livestock grazing.

This unit is suited to the production of ponderosa pine, Douglas-fir, and sugar pine. It can produce about 4,396 cubic feet, or 20,000 board feet (Scribner rule), of timber per acre from a fully stocked stand of even-aged ponderosa pine trees 80 years old.

The main concerns in producing and harvesting timber are the hazard of erosion and plant competition. Spoil from excavations is subject to rill and gully erosion and to sloughing. Proper design of road drainage systems and care in the placement of culverts help to control erosion. Conventional methods of harvesting trees can be used.

If site preparation is not adequate, competition from undesirable plants can prevent or prolong natural or artificial reestablishment of trees. Competing vegetation can be controlled by proper site preparation. Among the trees that are suitable for planting are ponderosa pine and Douglas-fir.

When the density of the forest canopy is less than about 40 percent, this unit produces grazable understory. The understory includes vetch, Thurber needlegrass, and oak. Livestock grazing should be managed to protect the unit from excessive erosion.

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

118—Boomer Variant stony sandy loam, 5 to 30 percent slopes. This very deep, well drained soil is on mountains. It formed in residuum derived dominantly from sandstone. The native vegetation is mainly mixed conifers, shrubs, perennial grasses, and forbs. Elevation is 2,500 to 5,000 feet. The average annual precipitation is about 35 inches, the average annual air temperature is about 48 degrees F, and the average frost-free period is about 125 days.

Typically, the surface is covered with a mat of undecomposed and partially decomposed needles, leaves, twigs, bark, and other organic debris about 1 inch thick. The surface layer is brown and light brown stony sandy loam about 10 inches thick. The upper 15 inches of the subsoil is light yellowish brown stony sandy loam. The lower 45 inches is yellowish brown stony sandy clay loam, stony loam, and stony sandy loam. Weathered bedrock is at a depth of 70 inches. A few stones are on the surface in most places.

Included in this unit are small areas of Neuns gravelly loam and soils that are similar to this Boomer Variant soil but are 20 to 40 inches deep to hard sandstone or have slopes of as much as 50 percent. Also included are small areas of Rubble land and Rock outcrop. Included areas make up about 20 percent of the total acreage.

Permeability of this Boomer Variant soil is moderate. Available water capacity is low to moderate. Effective rooting depth is 60 to 80 inches. Runoff is medium to rapid, and the hazard of water erosion is moderate to high.

This unit is used as woodland and for livestock grazing.

This unit is suited to the production of ponderosa pine, Douglas-fir, and sugar pine. It can produce about 4,396 cubic feet, or 20,000 board feet (Scribner rule), of timber per acre from a fully stocked stand of even-aged ponderosa pine trees 80 years old.

The main concerns in producing and harvesting timber are the hazard of erosion and plant competition. Spoil from excavations is subject to rill and gully erosion and to sloughing. Proper design of road drainage systems and care in the placement of culverts help to control erosion. Among the trees that are suitable for planting are ponderosa pine and Douglas-fir. Competing vegetation can be controlled by proper site preparation.

When the density of the forest canopy is less than about 40 percent, this unit produces grazable understory vegetation. The understory vegetation includes ceanothus, vetch, and needlegrass.

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

119—Chaix-Chawanakee gravelly coarse sandy loams, 5 to 30 percent slopes. This map unit is on mountains. The native vegetation is mainly mixed conifers. Elevation is 2,500 to 5,000 feet. The average annual precipitation is about 35 inches, the average

annual air temperature is about 48 degrees F, and the average frost-free period is about 125 days.

This unit is 50 percent Chaix gravelly coarse sandy loam and 25 percent Chawanakee gravelly coarse sandy loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of a soil that is similar to the Chaix soil but is loamy sand or sand throughout or is more than 40 inches deep to weathered rock. Also included is a soil that is similar to the Chawanakee soil but is underlain by hard bedrock at a depth of 10 to 20 inches. Included areas make up about 25 percent of the total acreage.

The Chaix soil is moderately deep and well drained. It formed in residuum derived dominantly from granitic rock. Typically, the surface is covered with a mat of undecomposed and partially decomposed needles, leaves, twigs, bark, and other organic debris about 1 inch thick. The surface layer is brown gravelly coarse sandy loam about 4 inches thick. The subsoil is very pale brown coarse sandy loam about 24 inches thick. The substratum is light yellowish brown gravelly coarse sandy loam about 6 inches thick. Weathered rock is at a depth of 34 inches.

Permeability of the Chaix soil is moderately rapid. Available water capacity is very low to low. Effective rooting depth is 20 to 40 inches. Runoff is medium to rapid, and the hazard of water erosion is moderate to high.

The Chawanakee soil is shallow and somewhat excessively drained. It formed in residuum derived dominantly from granitic rock. Typically, the surface is covered with a mat of undecomposed and partially decomposed needles, leaves, twigs, bark, and other organic debris about 1 inch thick. The surface layer is light brownish gray gravelly coarse sandy loam about 4 inches thick. The subsoil is pale brown gravelly coarse sandy loam about 12 inches thick. Weathered rock is at a depth of 16 inches.

Permeability of the Chawanakee soil is moderately rapid. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is medium to rapid, and the hazard of water erosion is moderate to high.

This unit is used as woodland and for livestock grazing.

The Chaix soil is suited to the production of ponderosa pine, Douglas-fir, white fir, and sugar pine. It can produce about 3,693 cubic feet, or 16,610 board feet (Scribner rule), of timber per acre from a fully stocked stand of even-aged ponderosa pine trees 80 years old.

The Chawanakee soil is poorly suited to the production of ponderosa pine and Douglas-fir. It can produce about 2,859 cubic feet, or 12,830 board feet (Scribner rule), of timber per acre from a fully stocked stand of even-aged ponderosa pine trees 80 years old.

Management that minimizes the risk of erosion is essential in harvesting timber.

The main concerns in producing and harvesting timber are the hazard of erosion, seedling mortality, and plant competition. Windthrow is a hazard on the Chawanakee soil because of shallow soil depth. Spoil from excavations is subject to rill and gully erosion and to sloughing. Proper design of road drainage systems and care in the placement of culverts help to control erosion.

The low available water capacity of the Chaix soil generally influences seedling survival in areas where understory plants are numerous. Proper site preparation controls initial plant competition.

Reforestation is limited by shallow soil depth and droughtiness. Among the trees that are suitable for planting are ponderosa pine and Douglas-fir.

The understory vegetation includes manzanita and buckbrush.

This map unit is in capability unit IVe-4(5), nonirrigated.

120—Chaix-Chawanakee gravelly coarse sandy loams, 30 to 50 percent slopes. This map unit is on mountains. The native vegetation is mainly mixed conifers. Elevation is 2,500 to 5,000 feet. The average annual precipitation is about 35 inches, the average annual air temperature is about 48 degrees F, and the average frost-free period is about 125 days.

This unit is 50 percent Chaix gravelly coarse sandy loam and 25 percent Chawanakee gravelly coarse sandy loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of soils that are similar to the Chaix soil but are loamy sand or sand throughout or are more than 40 inches deep to weathered rock. Also included are small areas of Rock outcrop. Included areas make up about 25 percent of the total acreage.

The Chaix soil is moderately deep and well drained. It formed in residuum derived dominantly from granitic rock. Typically, the surface is covered with a mat of undecomposed and partially decomposed needles, leaves, twigs, bark, and other organic debris about 1 inch thick. The surface layer is brown gravelly coarse sandy loam about 4 inches thick. The subsoil is very pale brown gravelly coarse sandy loam about 24 inches thick. The substratum is light yellowish brown gravelly coarse sandy loam about 6 inches thick. Weathered rock is at a depth of 34 inches.

Permeability of the Chaix soil is moderately rapid. Available water capacity is very low to low. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

The Chawanakee soil is shallow and somewhat excessively drained. It formed in residuum derived dominantly from granitic rock. Typically, the surface is covered with a mat of undecomposed and partially

decomposed needles, leaves, twigs, bark, and other organic debris about 1 inch thick. The surface layer is light brownish gray gravelly coarse sandy loam about 4 inches thick. The subsoil is pale brown gravelly coarse sandy loam about 12 inches thick. Weathered rock is at a depth of 16 inches.

Permeability of the Chawanakee soil is moderately rapid. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used as woodland.

The Chaix soil is suited to the production of ponderosa pine, Douglas-fir, white fir, and sugar pine. It can produce about 3,693 feet, or 16,610 board feet (Scribner rule), of timber per acre from a fully stocked stand of even-aged ponderosa pine trees 80 years old.

The Chawanakee soil is poorly suited to the production of ponderosa pine and Douglas-fir. It can produce about 2,869 cubic feet, or 12,830 board feet (Scribner rule), of timber per acre from a fully stocked stand of even-aged ponderosa pine trees 80 years old. Management that minimizes the risk of erosion is essential in harvesting timber.

The main concerns in producing and harvesting timber are the hazard of erosion, seedling mortality, and plant competition. Spoil from excavations is subject to rill and gully erosion and to sloughing. Proper design of road drainage systems and care in the placement of culverts help to control erosion. Conventional methods of harvesting trees generally can be used but are difficult to apply in the steeper areas.

The low available water capacity generally influences seedling survival in areas where understory plants are numerous. Proper site preparation controls initial plant competition, and spraying controls subsequent growth.

Reforestation is limited by shallow soil depth and droughtiness. Among the trees that are suitable for planting are ponderosa pine and Douglas-fir.

The understory includes manzanita and buckbrush.

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

121—Chaix-Chawanakee gravelly coarse sandy loams, 50 to 70 percent slopes. This map unit is on mountains. The native vegetation is mainly mixed conifers. Elevation is 2,500 to 5,000 feet. The average annual precipitation is about 35 inches, the average annual air temperature is about 48 degrees F, and the average frost-free period is about 125 days.

This unit is 50 percent Chaix gravelly coarse sandy loam and 25 percent Chawanakee gravelly coarse sandy loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of a soil that is similar to the Chaix soil but is loamy sand or sand throughout, a soil that is similar to the Chawanakee soil

but is underlain by hard bedrock, and Rock outcrop. Included areas make up about 25 percent of the total acreage.

The Chaix soil is moderately deep and well drained. It formed in residuum derived dominantly from granitic rock. Typically, the surface is covered with a mat of undecomposed and partially decomposed needles, leaves, twigs, bark, and other organic debris about 1 inch thick. The surface layer is brown gravelly coarse sandy loam about 4 inches thick. The subsoil is very pale brown gravelly coarse sandy loam about 24 inches thick. The substratum is light yellowish brown gravelly coarse sandy loam about 6 inches thick. Weathered rock is at a depth of 34 inches.

Permeability of the Chaix soil is moderately rapid. Available water capacity is very low to low. Effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of water erosion is very high.

The Chawanakee soil is shallow and somewhat excessively drained. It formed in residuum derived dominantly from granitic rock. Typically, the surface is covered with a mat of undecomposed and partially decomposed needles, leaves, twigs, bark, and other organic debris about 1 inch thick. The surface layer is light brownish gray gravelly coarse sandy loam about 4 inches thick. The subsoil is pale brown gravelly coarse sandy loam about 12 inches thick. Weathered rock is at a depth of 16 inches.

Permeability of the Chawanakee soil is moderately rapid. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is very rapid, and the hazard of water erosion is very high.

This unit is used as woodland.

The Chaix soil is suited to the production of ponderosa pine, Douglas-fir, white fir, and sugar pine. It can produce about 3,693 cubic feet, or 16,610 board feet (Scribner rule), of timber per acre from a fully stocked stand of even-aged ponderosa pine trees 80 years old.

The Chawanakee soil is poorly suited to the production of ponderosa pine and Douglas-fir. It can produce about 2,859 cubic feet, or 12,830 board feet (Scribner rule), of timber per acre from a fully stocked stand of even-aged ponderosa pine trees 80 years old.

The main concerns in producing and harvesting timber on both soils are the hazard of erosion, equipment limitations, seedling mortality, and plant competition. Management that minimizes the risk of erosion is essential in harvesting timber. Spoil from excavations is subject to rill and gully erosion and to sloughing. Proper design of road drainage systems and care in the placement of culverts help to control erosion. Steepness of slope limits the kinds of equipment that can be used in forest management.

Reforestation is limited by shallow soil depth and droughtiness. The low available water capacity generally influences seedling survival in areas where understory plants are numerous. Proper site preparation controls

initial plant competition, and spraying controls subsequent growth. Among the trees that are suitable for planting on this unit are ponderosa pine and Douglas-fir.

The understory includes manzanita and buckbrush.

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

122—Copsey clay, 0 to 9 percent slopes. This very deep, poorly drained soil is on alluvial fans. It formed in alluvium derived dominantly from serpentine. The vegetation in areas not cultivated is mainly perennial grasses and forbs. Elevation is 2,500 to 3,500 feet. The average annual precipitation is about 20 inches, the average annual air temperature is about 50 degrees F, and the average frost-free period is about 125 days.

Typically, the surface layer is very dark brown and black clay about 18 inches thick. The underlying material to a depth of 60 inches or more is very dark gray, dark gray, and dark grayish brown gravelly clay.

Included in this unit are small areas of a Dubakella stony loam that has slopes of less than 5 percent, a soil that is similar to this Copsey soil but formed in alluvium that is low in content of serpentine minerals, a soil that is similar to this Copsey soil but has slopes of as much as 30 percent, and Rock outcrop. Included areas make up about 15 percent of the total acreage.

Permeability of this Copsey soil is very slow. Available water capacity is moderate to high. Effective rooting depth is 60 inches or more. Runoff is slow to medium, and the hazard of water erosion is slight to moderate. A seasonal high water table is at a depth of 6 to 18 inches from December through March. The rest of the year it fluctuates between depths of 18 and 40 inches.

This unit is used for hay and pasture and as rangeland.

This unit is suited to irrigated hay and pasture. The main limitations are the high water table, very slow permeability, compaction, and fertility. Proper grazing practices, weed control, and fertilizer are needed for maximum quality of forage.

Because of the very slow permeability of the soil, sprinkler irrigation is best suited to this unit. Irrigation water must be applied carefully to prevent the development of a perched water table.

Wetness limits the choice of plants and the period of cutting or grazing and increases the risk of winterkill. Grazing when the soil is wet results in compaction of the surface layer and excessive runoff.

This unit is suited to use as rangeland. The production of vegetation suitable for livestock grazing is limited by the high water table, shrink-swell potential, and low fertility.

Range seeding is a suitable practice if the range is in poor condition. Plants that tolerate wetness and high shrink-swell potential should be seeded. Grazing should be delayed until the soil has drained sufficiently and is

firm enough to withstand trampling by livestock. Fertilizer is needed for optimum growth of grasses and legumes.

The potential plant community on this unit includes carex, rush, redtop, and bluegrass.

This map unit is in capability unit IIIw-5(21), irrigated and nonirrigated.

123—Copsey gravelly clay, 2 to 9 percent slopes.

This very deep, poorly drained soil is on alluvial fans. It formed in alluvium derived dominantly from serpentine. The vegetation in areas not cultivated is mainly perennial grasses and forbs. Elevation is 2,500 to 3,500 feet. The average annual precipitation is about 20 inches, the average annual air temperature is about 50 degrees F, and the average frost-free period is about 125 days.

Typically, the surface layer is very dark brown gravelly clay about 18 inches thick. The underlying material to a depth of 60 inches or more is very dark gray, dark gray, and dark grayish brown gravelly clay.

Included in this unit are small areas of Dubakella stony loam, a moderately well drained soil that is similar to this Copsey soil but formed in alluvium that is low in serpentine materials and contains less gravel, soils that are similar to this Copsey soil but have slopes of 9 to 30 percent, and Rock outcrop. Included areas make up about 25 percent of the total acreage.

Permeability of this Copsey soil is very slow. Available water capacity is moderate to high. Effective rooting depth is 60 inches or more. Runoff is slow to medium, and the hazard of water erosion is slight to moderate. A seasonal high water table is at a depth of 6 to 18 inches from December through March.

This unit is used for hay and pasture and as rangeland.

This unit is suited to irrigated hay and pasture. The main limitations are the seasonal high water table, very slow permeability, gravel in the surface layer, and low fertility. Gravel in the surface layer causes rapid wear of equipment used for tillage. Proper grazing practices, weed control, and fertilizer are needed for maximum quality of forage.

Because of very slow permeability, sprinkler irrigation is best suited to this soil. Irrigation water must be applied carefully to prevent the development of a perched water table.

Wetness limits the choice of plants and the period of cutting or grazing and increases the risk of winterkill. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff.

This unit is suited to use as rangeland. The production of vegetation suitable for livestock grazing is limited by the high water table, shrink-swell potential, and low fertility. Grazing should be delayed until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.

Range seeding is a suitable practice if the range is in poor condition. Plants that tolerate wetness and high

shrink-swell potential should be seeded. Fertilizer is needed for optimum growth of grasses and legumes.

The potential plant community on this unit includes carex, rush, redtop, and bluegrass.

This map unit is in capability unit IIIw-5(21), irrigated and nonirrigated.

124—Copsey cobbly clay, 2 to 9 percent slopes.

This very deep, poorly drained soil is on alluvial fans. It formed in alluvium derived dominantly from serpentine. The vegetation in areas not cultivated is mainly perennial grasses and forbs. Elevation is 2,500 to 3,500 feet. The average annual precipitation is about 20 inches, the average annual air temperature is about 50 degrees F, and the average frost-free period is about 125 days.

Typically, the surface layer is very dark brown cobbly clay about 18 inches thick. The underlying material to a depth of 60 inches or more is very dark gray, dark gray, and dark grayish brown cobbly clay. A few cobbles are on the surface in most places.

Included in this unit are small areas of Dubakella stony loam, moderately well drained soils that are similar to this Copsey soil but formed in alluvium that is low in content of serpentine minerals or have slopes of as much as 30 percent, and Rock outcrop. Included areas make up about 20 percent of the total acreage.

Permeability of this Copsey soil is very slow. Available water capacity is moderate to high. Effective rooting depth is 60 inches or more. Runoff is slow to medium, and the hazard of water erosion is slight to moderate. A seasonal high water table is at a depth of 6 to 18 inches from December through March.

This unit is used as rangeland.

This unit is suited to use as rangeland. The production of vegetation suitable for livestock grazing is limited by the seasonal high water table, shrink-swell potential, and low fertility. Fertilizer is needed for optimum growth of grasses and legumes. Use of mechanical treatment practices is not practical, because the surface is cobbly. Grazing should be delayed until the soil has drained sufficiently and is firm enough to withstand trampling by livestock. Plants that tolerate wetness and high shrink-swell potential should be seeded.

The potential plant community on this unit includes carex, rush, redtop, and bluegrass.

This map unit is in capability unit IVw-7(21), nonirrigated.

125—Deetz gravelly loamy sand, 0 to 5 percent slopes. This very deep, somewhat excessively drained soil is on glacial outwash fans. It formed in glaciofluvial deposits derived dominantly from mixed extrusive igneous rock and volcanic ash. The native vegetation is mainly mixed conifers, shrubs, perennial grasses, and forbs. Elevation is 3,000 to 5,000 feet. The average annual precipitation is about 40 inches, the average

annual air temperature is about 48 degrees F, and the average frost-free period is about 125 days.

Typically, the surface is covered with a mat of undecomposed and partially decomposed needles, leaves, twigs, bark, and other organic debris about 1/2 inch thick. The surface layer is very dark grayish brown, dark brown, and brown gravelly loamy sand about 7 inches thick. The upper 31 inches of the underlying material is pale brown, light yellowish brown, and very pale brown gravelly loamy sand. The lower part to a depth of 65 inches or more is pale brown, gray, and light gray very gravelly sand.

Included in this unit are small areas of a soil that is similar to this Deetz soil but is very gravelly throughout, Rock outcrop, Riverwash, and Xerofluvents. Included areas make up about 15 percent of the total acreage.

Permeability of this Deetz soil is rapid. Available water capacity is very low to low. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used as woodland and for homesite development.

This unit is suited to the production of ponderosa pine, white fir, and Douglas-fir. It can produce about 6,250 cubic feet, or 29,280 board feet (Scribner rule), of timber per acre from a fully stocked stand of even-aged ponderosa pine trees 80 years old.

The main concerns in producing and harvesting timber are seedling mortality and plant competition. Reforestation must be carefully managed to reduce competition from undesirable understory plants. If site preparation is not adequate, competition from undesirable plants can prevent or prolong natural or artificial reestablishment of trees. Proper site preparation controls initial plant competition, and spraying controls subsequent growth. The very low to low available water capacity of the soil in this unit generally influences seedling survival in areas where understory plants are numerous. Among the trees that are suitable for planting are ponderosa pine and Douglas-fir.

The understory includes manzanita, squawcarpet, and bitterbrush.

This unit is suited to homesite development. The main limitations are seepage and droughtiness. Mulch, fertilizer, and irrigation are needed to establish lawn grasses and other small seeded plants.

If the density of housing is moderate to high, community sewage systems are needed to prevent contamination of water supplies as a result of the rapidly permeable soil serving as a poor filter for effluent.

This map unit is in capability unit IVs-4(21), nonirrigated.

126—Deetz gravelly loamy sand, 5 to 15 percent slopes. This very deep, somewhat excessively drained soil is on glacial outwash fans. It formed in glaciofluvial deposits derived dominantly from mixed extrusive

igneous rock and volcanic ash. The native vegetation is mainly mixed conifers, shrubs, perennial grasses, and forbs. Elevation is 3,000 to 5,000 feet. The average annual precipitation is about 40 inches, the average annual air temperature is about 48 degrees F, and the average frost-free period is about 125 days.

Typically, the surface is covered with a mat of undecomposed and partially decomposed needles, leaves, twigs, bark, and other organic debris about 1/2 inch thick. The surface layer is very dark grayish brown, dark brown, and brown gravelly loamy sand about 7 inches thick. The upper 31 inches of the underlying material is pale brown, light yellowish brown, and very pale brown gravelly loamy sand. The lower part to a depth of 65 inches or more is pale brown, gray, and light gray very gravelly sand.

Included in this unit are small areas of soils that are similar to this Deetz soil but are very gravelly throughout or have slopes of as much as 30 percent. Also included are a few small areas of Rock outcrop. Included areas make up about 15 percent of the total acreage.

Permeability of this Deetz soil is rapid. Available water capacity is very low to low. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland and for homesite development.

This unit is suited to the production of ponderosa pine, white fir, and Douglas-fir. It can produce about 6,250 cubic feet, or 29,280 board feet (Scribner rule), of timber per acre from a fully stocked stand of even-aged ponderosa pine trees 80 years old.

The main concerns in producing and harvesting timber are seedling mortality and plant competition. Reforestation must be carefully managed to reduce competition from undesirable understory plants. The very low or low available water capacity generally influences seedling survival in areas where understory plants are numerous. Among the trees that are suitable for planting are ponderosa pine and Douglas-fir.

The understory includes manzanita, squawcarpet, and bitterbrush.

This unit is suited to homesite development. The main limitations are seepage and droughtiness. Mulching, fertilizing, and irrigating are needed to establish lawn grasses and other small seeded plants.

If the density of housing is moderate to high, community sewage systems are needed to prevent contamination of water supplies as a result of the rapidly permeable subsoil serving as a poor filter for effluent.

This map unit is in capability unit IVs-4(21), nonirrigated.

127—Deetz stony loamy sand, 2 to 15 percent slopes. This very deep, somewhat excessively drained soil is on glacial outwash fans. It formed in glaciofluvial deposits derived dominantly from mixed extrusive

igneous rock and volcanic ash. The native vegetation is mainly mixed conifers, shrubs, perennial grasses, and forbs. Elevation is 3,000 to 5,000 feet. The average annual precipitation is about 40 inches, the average annual air temperature is about 48 degrees F, and the average frost-free period is about 125 days.

Typically, the surface is covered with a mat of undecomposed and partially decomposed needles, leaves, twigs, bark, and other organic debris about 1/2 inch thick. The surface layer is very dark grayish brown, dark brown, and brown stony loamy sand about 7 inches thick. The upper 31 inches of the underlying material is pale brown, light yellowish brown, and very pale brown cobbly loamy sand. The lower part to a depth of 65 inches or more is pale brown, gray, and light gray very cobbly sand. A few stones are on the surface in most places.

Included in this unit are small areas of a soil that is similar to this Deetz soil but has slopes of 15 to 30 percent. Also included are small areas of Rubble land. Included areas make up about 15 percent of the total acreage.

Permeability of this Deetz soil is rapid. Available water capacity is very low. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland and for homesite development.

This unit is suited to the production of ponderosa pine, white fir, and Douglas-fir. It can produce about 6,250 cubic feet, or 29,280 board feet (Scribner rule), of timber per acre from a fully stocked stand of even-aged ponderosa pine trees 80 years old.

The main concerns in producing and harvesting timber are seedling mortality and plant competition. Reforestation must be carefully managed to reduce competition from undesirable understory plants. The very low available water capacity of the soil in this unit generally influences seedling survival in areas where understory plants are numerous. Among the trees that are suitable for planting are ponderosa pine and Douglas-fir.

The understory includes manzanita, squawcarpet, and bitterbrush.

This unit is suited to homesite development. The main limitations are seepage, droughtiness, and stones. Removal of stones and cobbles in disturbed areas is required for best results when landscaping, particularly in areas used for lawns. Mulch, fertilizer, and irrigation are needed to establish lawn grasses and other small seeded plants.

If the density of housing is moderate to high, community sewage systems are needed to prevent contamination of water supplies as a result of the rapidly permeable soil serving as a poor filter for effluent.

This map unit is in capability subclass VI(21), nonirrigated.

128—Deetz stony loamy sand, 15 to 30 percent slopes. This very deep, somewhat excessively drained soil is on glacial outwash fans. It formed in glaciofluvial deposits derived dominantly from mixed extrusive igneous rock and volcanic ash. The native vegetation is mainly mixed conifers, shrubs, perennial grasses, and forbs. Elevation is 3,000 to 5,000 feet. The average annual precipitation is about 40 inches, the average annual air temperature is about 48 degrees F, and the average frost-free period is about 125 days.

Typically, the surface is covered with a mat of undecomposed and partially decomposed needles, leaves, twigs, bark, and other organic debris about 1 inch thick. The surface layer is very dark grayish brown, dark brown, and brown stony loamy sand about 7 inches thick. The upper 31 inches of the underlying material is pale brown, light yellowish brown, and very pale brown cobbly loamy sand. The lower part to a depth of 65 inches or more is pale brown, gray, and light gray very cobbly sand. A few stones are on the surface in most places.

Included in this unit are small areas of a soil that is similar to this Deetz soil but is very gravelly throughout. Also included are small areas of Rubble land. Included areas make up about 15 percent of the total acreage.

Permeability of this Deetz soil is rapid. Available water capacity is very low. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

This unit is used as woodland and for homesite development.

This unit is suited to the production of ponderosa pine, white fir, and Douglas-fir. It can produce about 6,250 cubic feet, or 29,280 board feet (Scribner rule), of timber per acre from a fully stocked stand of even-aged ponderosa pine trees 80 years old.

The main concerns in producing and harvesting timber are seedling mortality and plant competition. Reforestation must be carefully managed to reduce competition from undesirable understory plants. The very low available water capacity of the soil in this unit generally influences seedling survival in areas where understory plants are numerous. Among the trees that are suitable for planting are Douglas-fir and ponderosa pine.

The understory includes manzanita, squawcarpet, and bitterbrush.

This unit is suited to homesite development. The main limitations are seepage, stones, and slope. Removal of stones and cobbles in disturbed areas is required for best results when landscaping, particularly in areas used for lawns. Mulch, fertilizer, and irrigation are needed to establish lawn grasses and other small seeded plants.

The steepness of slope is a concern in installing septic tank absorption fields. Absorption lines should be installed on the contour. If the density of housing is moderate to high, community sewage systems are

needed to prevent contamination of water supplies as a result of the rapidly permeable soil serving as a poor filter for effluent.

This map unit is in capability subclass VI(21), nonirrigated.

129—Delaney sand, 0 to 9 percent slopes. This very deep, somewhat excessively drained soil is on glacial outwash fans. It formed in glaciofluvial deposits derived dominantly from mixed extrusive igneous rock and volcanic ash. The vegetation in areas not cultivated is mainly perennial grasses, shrubs, and forbs. Elevation is 2,800 to 4,500 feet. The average annual precipitation is about 13 inches, the average annual air temperature is about 50 degrees F, and the average frost-free period is about 125 days.

Typically, the surface layer is grayish brown sand about 9 inches thick. The underlying material to a depth of 68 inches or more is grayish brown, pale brown, light gray, very pale brown, and white sand.

Included in this unit are small areas of Plutos loamy sand, Rubble land, and Xerofluvents. Included areas make up about 20 percent of the total acreage.

Permeability of this Delaney soil is rapid. Available water capacity is low. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is high.

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

This unit is suited to irrigated hay and pasture. The main limitations are droughtiness and low fertility. Proper grazing practices, weed control, and fertilizer are needed for maximum quality of forage.

Sprinkler irrigation is the most suitable method of applying water. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crop needs.

This unit is poorly suited to use as rangeland. The production of vegetation suitable for livestock grazing is limited by droughtiness, low fertility, and the hazard of erosion. If the range vegetation is seriously deteriorated, seeding is needed. Plants that tolerate droughtiness and low fertility should be seeded. The soil in this unit is limited for livestock watering ponds and other water impoundments because of the seepage potential. Proper grazing use will reduce the risk of soil blowing.

The potential plant community on this unit includes western juniper, manzanita, and antelope bitterbrush.

This unit is suited to homesite development. The main limitations are seepage, the hazard of soil blowing, droughtiness, and low fertility. If the density of housing is moderate to high, community sewage systems are needed to prevent contamination of water supplies as a result of the rapidly permeable soil serving as a poor filter for effluent.

Revegetating disturbed areas around construction sites as soon as possible helps to control soil blowing. Mulch, fertilizer, and irrigation are needed to establish lawn grasses and other small seeded plants.

This map unit is in capability unit IIIs-4(21), irrigated, and capability subclass VIe(21), nonirrigated.

130—Delaney gravelly sand, 0 to 9 percent slopes.

This very deep, somewhat excessively drained soil is on glacial outwash fans. It formed in glaciofluvial deposits derived dominantly from mixed extrusive igneous rock and volcanic ash. The vegetation in areas not cultivated is mainly perennial grasses, shrubs, and forbs. Elevation is 2,800 to 4,500 feet. The average annual precipitation is about 13 inches, the average annual air temperature is about 50 degrees F, and the average frost-free period is about 125 days.

Typically, the surface layer is grayish brown gravelly sand about 9 inches thick. The underlying material to a depth of 68 inches or more is grayish brown, pale brown, light gray, very pale brown, and white gravelly sand.

Included in this unit are small areas of Plutos loamy sand, Rubble land, and Riverwash. Included areas make up about 15 percent of the total acreage.

Permeability of this Delaney soil is rapid. Available water capacity is very low to low. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is high.

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

This unit is suited to irrigated hay and pasture. The main limitations are droughtiness, low fertility, and the gravelly surface layer. Proper grazing practices, weed control, and fertilizer are needed for maximum quality of forage. Use of proper stocking rates, pasture rotation, and restricted grazing during wet periods helps to keep the pasture in good condition and to protect the soil from erosion. Gravel in the surface layer causes rapid wear of equipment used for tillage.

Sprinkler irrigation is the most suitable method of applying water. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crop needs.

This unit is poorly suited to use as rangeland. The production of vegetation suitable for livestock grazing is limited by droughtiness, low fertility, and the hazard of erosion. If the range vegetation is seriously deteriorated, seeding is needed. Plants that tolerate droughtiness and low fertility should be seeded. Livestock grazing should be managed to protect the soil from excessive soil blowing. The soil in this unit is limited for livestock watering ponds and other water impoundments because of the seepage potential.

The potential plant community on this unit is mainly western juniper, manzanita, and antelope bitterbrush.

This unit is suited to homesite development. The main limitations are the hazard of soil blowing, seepage, gravel in the soil, droughtiness, and low fertility. If the density of housing is moderate to high, community sewage systems are needed to prevent contamination of water supplies as a result of the rapidly permeable soil serving as a poor filter for effluent.

Revegetating disturbed areas around construction sites as soon as possible helps to control soil blowing. Removal of pebbles in disturbed areas is required for best results when landscaping, particularly in areas used for lawns. Mulching, fertilizing, and irrigating are needed to establish lawn grasses and other small seeded plants.

This map unit is in capability unit IVs-4(21), irrigated, and capability subclass VIe(21), nonirrigated.

131—Delaney stony sand, 0 to 15 percent slopes.

This deep, somewhat excessively drained soil is on glacial outwash fans. It formed in glaciofluvial deposits derived dominantly from mixed extrusive igneous rock and volcanic ash. The vegetation in areas not cultivated is mainly perennial grasses, shrubs, and forbs. Elevation is 2,800 to 4,500 feet. The average annual precipitation is about 13 inches, the average annual air temperature is about 50 degrees F, and the average frost-free period is about 125 days.

Typically, the surface layer is grayish brown stony sand about 9 inches thick. The underlying material is grayish brown, pale brown, light gray, very pale brown, and white stony sand about 36 inches thick. Hard bedrock is at a depth of 45 inches. A few stones are on the surface in most places.

Included in this unit are small areas of a soil that is similar to this Delaney soil but has a sand surface layer, Plutos loamy sand, Riverwash, and Lava flows. Also included are small areas of soils that have slopes of more than 15 percent and are moderately or severely eroded. Included areas make up about 20 percent of the total acreage.

Permeability of this Delaney soil is rapid. Available water capacity is low. Effective rooting depth is 40 to 60 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is high.

This unit is used as rangeland and for homesite development.

This unit is poorly suited to use as rangeland. The production of vegetation suitable for livestock grazing is limited mainly by droughtiness, low fertility, the hazard of soil blowing, and stones on the surface. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of species is maintained in the plant community.

Proper grazing use helps to control soil blowing. If reseeding is necessary, only plants that can tolerate drought or low fertility should be used. Use of

mechanical treatment practices is not practical, because the surface is stony. The soil in this unit is limited for livestock watering ponds and other water impoundments because of the seepage potential.

The potential plant community on this unit includes western juniper, manzanita, and big sagebrush.

This unit is poorly suited to homesite development. The main limitations are seepage, limited depth to rock, droughtiness, low fertility, the hazard of soil blowing, and stones. If the density of housing is moderate to high, community sewage systems are needed to prevent contamination of water supplies as a result of the rapidly permeable soil and bedrock serving as poor filters for effluent. The deep cuts needed to provide essentially level building sites can expose bedrock.

Removal of stones and cobbles in disturbed areas is required for best results when landscaping, particularly in areas used for lawns. Revegetating disturbed areas around construction sites as soon as possible helps to control soil blowing. Mulching, fertilizing, and irrigating are needed to establish lawn grasses and other small seeded plants.

This map unit is in capability subclass Vle(21), nonirrigated.

132—Delaney sandy loam, 0 to 2 percent slopes.

This very deep, somewhat excessively drained soil is on glacial outwash fans. It formed in glaciofluvial deposits derived dominantly from mixed extrusive igneous rock and volcanic ash. The vegetation in areas not cultivated is mainly perennial grasses, shrubs, and forbs. Elevation is 2,800 to 4,500 feet. The average annual precipitation is about 13 inches, the average annual air temperature is about 50 degrees F, and the average frost-free period is about 125 days.

Typically, the surface layer is grayish brown sandy loam about 9 inches thick. The underlying material to a depth of 68 inches or more is grayish brown, pale brown, light gray, very pale brown, and white sand.

Included in this unit are small areas of Plutos loamy sand, Riverwash, and Xerofluvents. Included areas make up about 15 percent of the total acreage.

Permeability of this Delaney soil is rapid. Available water capacity is low. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate.

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

This unit is suited to irrigated hay and pasture. The main limitations are droughtiness and low fertility. Proper grazing practices, weed control, and fertilizer are needed for maximum quality of forage.

Sprinkler irrigation is the most suitable method of applying water. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crop needs.

This unit is poorly suited to use as rangeland. The production of vegetation suitable for livestock grazing is limited by droughtiness, low fertility, and the hazard of soil blowing. If the range vegetation is seriously deteriorated, seeding is needed. Only plants that tolerate droughtiness and low fertility should be seeded. Livestock grazing should be managed to protect the soil from excessive soil blowing. The soil in this unit is limited for livestock watering ponds and other water impoundments because of the seepage potential.

The potential plant community on this unit includes bottlebrush squirreltail, Thurber needlegress, rubber rabbitbrush, and redstem filaree.

This unit is suited to homesite development. The main limitations are seepage, the hazard of erosion, droughtiness, and low fertility. If the density of housing is moderate to high, community sewage systems are needed to prevent contamination of water supplies as a result of the rapidly permeable soil serving as a poor filter for effluent.

Revegetating disturbed areas around construction sites as soon as possible helps to control soil blowing. Mulching, fertilizing, and irrigating are needed to establish lawn grasses and other small seeded plants.

This map unit is in capability units IIIs-4(21), irrigated, and IIIe-4(21), nonirrigated.

133—Delaney sandy loam, 2 to 5 percent slopes.

This very deep, somewhat excessively drained soil is on glacial outwash fans. It formed in glaciofluvial deposits derived dominantly from mixed extrusive igneous rock and volcanic ash. The vegetation in areas not cultivated is mainly perennial grasses, shrubs, and forbs. Elevation is 2,800 to 4,500 feet. The average annual precipitation is about 13 inches, the average annual air temperature is about 50 degrees F, and the average frost-free period is about 125 days.

Typically, the surface layer is grayish brown sandy loam about 9 inches thick. The underlying material to a depth of 68 inches or more is pale brown, light gray, very pale brown, and white sand.

Included in this unit are small areas of Plutos loamy sand, Riverwash, and Xerofluvents. Included areas make up about 15 percent of the total acreage.

Permeability of this Delaney soil is rapid. Available water capacity is low. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate.

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

This unit is suited to irrigated hay and pasture. The main limitations are droughtiness and low fertility. Proper grazing practices, weed control, and fertilizer are needed for maximum quality of forage.

Sprinkler irrigation is the most suitable method of applying water. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be

adjusted to the available water capacity, the water intake rate, and the crop needs.

This unit is poorly suited to use as rangeland. The production of vegetation suitable for livestock grazing is limited by droughtiness, low fertility, and the hazard of soil blowing.

If the range vegetation is seriously deteriorated, seeding is needed. Plants that tolerate droughtiness and low fertility should be seeded. Livestock grazing should be managed to protect the soil from excessive soil blowing. The soil in this unit is limited for livestock watering ponds and other water impoundments because of the seepage potential.

The potential plant community on this unit includes bottlebrush squirreltail, Thurber needlegrass, rubber rabbitbrush, and redstem filaree.

This unit is suited to homesite development. The main limitations are seepage, the hazard of soil blowing, droughtiness, and low fertility. If the density of housing is moderate to high, community sewage systems are needed to prevent contamination of water supplies as a result of the rapidly permeable soil serving as a poor filter for effluent.

Revegetating disturbed areas around construction sites as soon as possible helps to control soil blowing. Mulching, fertilizing, and irrigating are needed to establish lawn grasses and other small seeded plants.

This map unit is in capability unit IIIe-4(21), irrigated and nonirrigated.

134—Delaney Variant silt, 0 to 2 percent slopes.

This very deep, well drained soil is on glacial outwash plains. It formed in glaciofluvial deposits derived dominantly from extrusive igneous rock. The vegetation in areas not cultivated is mainly perennial grasses, shrubs, and forbs. Elevation is 2,800 to 4,500 feet. The average annual precipitation is about 13 inches, the average annual air temperature is about 50 degrees F, and the average frost-free period is about 125 days.

Typically, the surface layer is gray silt about 7 inches thick. The underlying material to a depth of 60 inches or more is stratified and is gray, light gray, and grayish brown silt, loamy fine sand, loamy sand, sandy loam, and coarse sand.

Included in this unit are small areas of Delaney sandy loam, Plutos loamy sand, a soil that is similar to this Delaney Variant soil but is underlain at a depth of 20 to 40 inches by a strongly cemented pumice layer, and Xerofluvents. Included areas make up about 15 percent of the total acreage.

Permeability of this Delaney Variant soil is moderately slow. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. This soil is subject to frequent but brief periods of flooding in July, August, and September.

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

This unit is suited to irrigated hay and pasture. The main limitations are low fertility and flooding in summer.

Sprinkler irrigation is the most suitable method of applying water. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crop needs.

Use of proper stocking rates, pasture rotation, and restricted grazing during wet periods helps to keep the pasture in good condition and to protect the soil from erosion. The risk of flooding can be reduced by the use of dikes and diversions.

This unit is suited to use as rangeland. The production of vegetation suitable for livestock grazing is limited by low fertility and flooding in summer. The soil responds well to fertilizer, to range seeding, and to proper grazing use. Areas that are heavily infested with undesirable plants can be improved by chemical or mechanical treatment. Plants that tolerate damaging deposition should be seeded. Grazing should be delayed until the soil is firm and the more desirable forage plants have achieved sufficient growth to withstand grazing pressure.

The potential plant community on this unit includes Idaho fescue, bluebunch wheatgrass, and beardless wheatgrass.

This unit is poorly suited to homesite development. The main limitations are the hazard of flooding and low fertility. Flooding can be controlled only by use of major flood control structures. Mulching, fertilizing, and irrigating are needed to establish lawn grasses and other small seeded plants.

This map unit is in capability units IIw-2(21), irrigated, and IIIw-2(21), nonirrigated.

135—Deven-Rubble land complex, 0 to 30 percent slopes.

This map unit is on plateaus. The native vegetation is mainly perennial grasses, shrubs, and forbs. Elevation is 3,500 to 4,000 feet. The average annual precipitation is about 16 inches, the average annual air temperature is about 48 degrees F, and the average frost-free period is about 125 days.

This unit is 40 percent Deven loam and 35 percent Rubble land. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Kuck clay loam, Pinehurst Variant, a soil that is similar to this Deven loam but is 20 to 40 inches deep to bedrock, and Rock outcrop. Included areas make up about 25 percent of the total acreage.

The Deven soil is shallow and well drained. It formed in residuum derived dominantly from andesitic rock. Typically, the surface layer is dark brown loam about 5 inches thick. The subsoil is dark brown clay loam and

clay about 12 inches thick. Bedrock is at a depth of 17 inches.

Permeability of this Deven soil is slow. Available water capacity is very low to low. Effective rooting depth is 10 to 20 inches. Runoff is slow to rapid, and the hazard of water erosion is slight to high.

Rubble land consists of areas of stones and boulders. These areas do not support vegetation.

This unit is used as rangeland.

This unit is poorly suited to use as rangeland. The production of vegetation suitable for livestock grazing is limited by stones and boulders on the surface and droughtiness. Cattle cannot graze areas uniformly because of the stones and boulders. Use of mechanical treatment practices is not practical because of the stones and boulders. Management practices suitable for use on this unit are proper range use, deferred grazing, and rotation grazing.

The potential plant community on this unit includes bluebunch wheatgrass, Nevada bluegrass, Thurber needlegrass, and western juniper.

This map unit is in capability subclass VII(21), nonirrigated.

136—Diyou loam. This very deep, somewhat poorly drained soil is on flood plains. It formed in alluvium derived from mixed rock sources. Slope is 0 to 2 percent. The vegetation in areas not cultivated is mainly perennial grasses, sedges, and other water-tolerant plants. Elevation is 2,000 to 4,000 feet. The average annual precipitation is about 18 inches, the average annual air temperature is about 50 degrees F, and the average frost-free period is about 125 days.

Typically, the surface layer is dark grayish brown loam about 11 inches thick. The underlying material to a depth of 60 inches or more is stratified grayish brown, gray, and light olive gray sandy loam, sandy clay loam, and clay loam. In some areas the surface layer is sandy loam.

Included in this unit are small areas of Esro silt loam, Settlemyer Variant silt loam, Stoner gravelly sandy loam, and Riverwash. Included areas make up about 15 percent of the total acreage.

Permeability of this Diyou soil is moderately slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. A seasonal high water table is at a depth of 24 to 36 inches from February through June. This soil is subject to flooding during prolonged, high-intensity storms. Damaging floods occur about 3 years out of 10. Channeling and deposition are common along streambanks.

This unit is used for cultivated crops, hay and pasture, and rangeland.

This unit is suited to irrigated and nonirrigated wheat and barley. It is limited mainly by the seasonal high water

table. Drainage can be provided by using tile systems to intercept water from higher lying areas.

Irrigation water must be applied carefully to prevent the development of a perched water table. Sprinkler irrigation is the most suitable method of applying water. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crop needs.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth.

This unit is suited to irrigated hay and pasture. The main limitation is the seasonal high water table. Wetness limits the choice of plants and the period of cutting or grazing. Grasses and legumes that require good drainage can be grown if a deep tile drainage system is installed. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Proper grazing practices, weed control, and fertilizer are needed for maximum quality of forage.

This unit is suited to use as rangeland. It has few limitations. The soil in the unit responds well to fertilizer, to range seeding, and to proper grazing use. Plants that tolerate wetness should be seeded. Grazing should be delayed until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.

The potential plant community on this unit includes carex, rush, tufted hairgrass, and bluegrass.

This unit is poorly suited to homesite development because of the hazard of flooding and the seasonal high water table.

This map unit is in capability unit IIIw-2(21), irrigated and nonirrigated.

137—Diyou loam, drained. This very deep, somewhat poorly drained soil is on flood plains. It formed in alluvium derived from mixed rock sources. Slope is 0 to 2 percent. The vegetation in areas not cultivated is mainly perennial grasses, sedges, and other water-tolerant plants. Elevation is 2,000 to 4,000 feet. The average annual precipitation is about 18 inches, the average annual air temperature is about 50 degrees F, and the average frost-free period is about 125 days.

Typically, the surface layer is dark grayish brown loam about 11 inches thick. The underlying material to a depth of 60 inches or more is stratified grayish brown, gray, and light olive gray sandy loam, sandy clay loam, and clay loam. In some areas the surface layer is sandy loam.

Included in this unit are small areas of Esro silt loam, Settlemyer Variant silt loam, Stoner gravelly sandy loam, and Riverwash. Included areas make up about 15 percent of the total acreage.

Permeability of this Diyou soil is moderately slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of

water erosion is slight. A seasonal high water table is at a depth of 36 to 60 inches from February through June. This soil is subject to rare periods of flooding.

This unit is used for cultivated crops, hay and pasture, rangeland, and homesite development. The main crops are irrigated and nonirrigated wheat and barley.

This unit is suited to irrigated and nonirrigated crops commonly grown in the area. It is limited mainly by the seasonal high water table. Drainage can be provided by using tile systems to intercept water from higher lying areas.

Irrigation water must be applied carefully to prevent raising the water table. Sprinkler irrigation is the most suitable method of applying water. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crop needs.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth.

This unit is suited to irrigated hay and pasture. The main limitation is the seasonal high water table. Grasses and legumes that require good drainage can be grown if a deep random tile system is installed. Proper grazing practices, weed control, and fertilizer are needed for maximum quality of forage. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff.

This unit is suited to use as rangeland. It has few limitations. The soil in this unit responds well to fertilizer, to range seeding, and to proper grazing use. Grazing should be delayed until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.

The potential plant community on this unit includes carex, rush, and tufted hairgrass.

This unit is poorly suited to homesite development. The main limitations are the high water table and the hazard of flooding. Septic tank absorption fields do not function properly during rainy periods because of wetness. Diversions that have outlets to bypass floodwater can be used to protect buildings and onsite sewage disposal systems from flooding. Landscaping plants that tolerate a seasonal high water table and droughtiness should be selected if drainage and irrigation are not provided.

This map unit is in capability units llw-2(21), irrigated, and llw-2(21), nonirrigated.

138—Diyou loam, peat substratum. This very deep, somewhat poorly drained soil is on flood plains. It formed in alluvium derived from mixed rock sources. Slope is 0 to 2 percent. The vegetation in areas not cultivated is mainly perennial grasses, sedges, and other water-tolerant plants. Elevation is 2,000 to 4,000 feet. The average annual precipitation is about 18 inches, the average annual air temperature is about 50 degrees F, and the average frost-free period is about 125 days.

Typically, the surface layer is dark grayish brown loam about 11 inches thick. The upper 29 inches of the underlying material is stratified, grayish brown, gray, and light olive gray sandy loam, sandy clay loam, and clay loam. The lower part to a depth of 62 inches is peat. In some areas the surface layer is sandy loam.

Included in this unit are small areas of a soil that is similar to this Diyou soil but has peat at a depth of 20 to 40 inches or has slopes of as much as 9 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Diyou soil is moderately slow to a depth of 40 inches and rapid below this depth. Available water capacity is very high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. A seasonal high water table is at a depth of 24 to 36 inches from February through June. This soil is subject to rare periods of flooding.

This unit is used for nonirrigated hay and pasture, rangeland, and urban development.

This unit is suited to nonirrigated hay and pasture. The main limitation is the seasonal high water table. Wetness limits the choice of plants and the period of cutting or grazing. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Proper grazing practices, weed control, and fertilizer are needed for maximum quality of forage.

This unit is suited to use as rangeland. It has few limitations. The soil in this unit responds well to fertilizer, to range seeding, and to proper grazing use. Plants that tolerate wetness should be seeded. Grazing should be delayed until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.

The potential plant community on this unit includes carex, rush, tufted hairgrass, and bluegrass.

This unit is poorly suited to urban development. The main limitations are the seasonal high water table, the hazard of flooding, and limited load supporting capacity.

This map unit is in capability unit llw-2(21), nonirrigated.

139—Dotta loam, 0 to 2 percent slopes. This very deep, well drained soil is on alluvial fans. It formed in alluvium derived from mixed rock sources. The vegetation in areas not cultivated is mainly perennial grasses, shrubs, and forbs. Elevation is 2,000 to 3,500 feet. The average annual precipitation is about 18 inches, the average annual air temperature is about 50 degrees F, and the average frost-free period is about 125 days.

Typically, the surface layer is dark grayish brown loam about 15 inches thick. The subsoil is dark grayish brown clay loam and dark brown sandy clay loam about 37 inches thick. The substratum to a depth of 62 inches or more is brown sandy clay loam.

Included in this unit are small areas of a soil that is similar to this Dotta soil but is mildly alkaline throughout

and is calcareous in a few places, Stoner gravelly sandy loam, and Riverwash. Included areas make up about 15 percent of the total acreage.

Permeability of this Dotta soil is moderately slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for irrigated and nonirrigated crops, hay and pasture, rangeland, and homesite development.

This unit is suited to crops commonly grown in the area. It has few limitations.

Furrow, border, corrugation, and sprinkler irrigation systems are suited to the soil in this unit. The method used generally is governed by the crop grown. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crop needs.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth.

This unit is suited to irrigated hay and pasture. Proper grazing practices, weed control, and fertilizer are needed for maximum quality of forage.

This unit is suited to use as rangeland. It has few limitations. The soil in this unit responds well to fertilizer, to range seeding, and to proper grazing use.

The potential plant community on this unit includes Idaho fescue, bluebunch wheatgrass, beardless wheatgrass, and buckbrush.

This unit is suited to homesite development. It has few limitations. Mulching, fertilizing, and irrigating are needed to establish lawn grasses and other small seeded plants. Septic tank absorption fields may not function properly because of the moderately slow permeability of the subsoil. Shrinking and swelling with alternate drying and wetting may be a problem in constructing buildings and roads.

This map unit is in capability subclasses Ilc(21), irrigated, and Illc(21), nonirrigated.

140—Dotta loam, 2 to 9 percent slopes. This very deep, well drained soil is on alluvial fans. It formed in alluvium derived from mixed rock sources. The vegetation in areas not cultivated is mainly perennial grasses, shrubs, and forbs. Elevation is 2,000 to 3,500 feet. The average annual precipitation is about 18 inches, the average annual air temperature is about 50 degrees F, and the average frost-free period is about 125 days.

Typically, the surface layer is dark grayish brown loam about 15 inches thick. The subsoil is dark grayish brown clay loam and dark brown sandy clay loam about 37 inches thick. The substratum to a depth of 62 inches or more is brown sandy clay loam.

Included in this unit are small areas of a soil that is similar to this Dotta soil but is mildly alkaline throughout

and is calcareous in a few places. Included areas make up about 15 percent of the total acreage.

Permeability of this Dotta soil is moderately slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for cultivated crops, hay and pasture, rangeland, and homesite development. The main crops are irrigated and nonirrigated wheat and barley.

This unit is suited to crops commonly grown in the area. It is limited mainly by slope and the hazard of erosion.

Furrow, border, corrugation, and sprinkler irrigation systems are suited to the soil in this unit. If furrow or corrugation irrigation systems are used, runs should be on the contour or across the slope. The method used generally is governed by the crop grown. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crop needs.

Erosion can be reduced if fall grain is seeded early, stubble-mulch tillage is used, and tillage and seeding are on the contour or across the slope. Waterways should be shaped and seeded to perennial grass. Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth.

This unit is suited to irrigated hay and pasture. Proper grazing practices, weed control, and fertilizer are needed for maximum quality of forage.

This unit is suited to use as rangeland. It has few limitations. The soil in this unit responds well to fertilizer, to range seeding, and to proper grazing use.

The potential plant community on this unit includes Idaho fescue, bluebunch wheatgrass, beardless wheatgrass, and buckbrush.

This unit is suited to homesite development. It has few limitations. Onsite sewage disposal systems may not function properly because of the moderately slowly permeable subsoil. Shrinking and swelling with alternate drying and wetting of the soil may be a problem in constructing buildings and roads. Mulching, fertilizing, and irrigating are needed to establish lawn grasses and other small seeded plants.

This map unit is in capability units Ile-1(21), irrigated, and Ille-1(21), nonirrigated.

141—Dotta gravelly loam, 0 to 2 percent slopes. This very deep, well drained soil is on alluvial fans. It formed in alluvium derived from mixed rock sources. The vegetation in areas not cultivated is mainly perennial grasses, shrubs, and forbs. Elevation is 2,000 to 3,500 feet. The average annual precipitation is about 18 inches, the average annual air temperature is about 50 degrees F, and the average frost-free period is about 125 days.

Typically, the surface layer is dark grayish brown gravelly loam about 15 inches thick. The subsoil is dark grayish brown gravelly clay loam and dark brown gravelly sandy clay loam about 37 inches thick. The substratum to a depth of 62 inches or more is brown gravelly sandy clay loam.

Included in this unit are small areas of a soil that is similar to this Dotta soil but is mildly alkaline throughout and is calcareous in a few places. Included areas make up about 15 percent of the total acreage.

Permeability of this Dotta soil is moderately slow. Available water capacity is low to moderate. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for cultivated crops, hay and pasture, rangeland, and homesite development. The main crops are irrigated and nonirrigated wheat and barley.

This unit is suited to crops commonly grown in the area. It is limited mainly by the low to moderate available water capacity and the gravelly surface layer.

Furrow, border, corrugation, and sprinkler irrigation systems are suited to the soil in this unit. The method used generally is governed by the crop grown. Leveling is needed in sloping areas for the efficient application and removal of irrigation water. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crop needs.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Gravel in the surface layer causes rapid wear of equipment used for tillage.

This unit is suited to hay and pasture. It has few limitations. Proper grazing practices, weed control, and fertilizer are needed for maximum quality of forage.

This unit is suited to use as rangeland. It has few limitations. The soil in this unit responds well to fertilizer, to range seeding, and to proper grazing use.

The potential plant community on this unit includes bluebunch wheatgrass, beardless wheatgrass, Idaho fescue, western juniper, and buckbrush.

This map unit is suited to homesite development. It has few limitations. Onsite sewage disposal systems may not function properly because of the moderately slowly permeable subsoil. Shrinking and swelling with alternate drying and wetting may be a problem in constructing buildings and roads.

Removal of pebbles and cobbles in disturbed areas is required for best results when landscaping, particularly in areas used for lawns. Mulching, fertilizing, and irrigating are needed to establish lawn grasses and other small seeded plants.

This map unit is in capability units IIs-4(21), irrigated, and IIIs-4(21), nonirrigated.

142—Dotta gravelly loam, 2 to 5 percent slopes.

This very deep, well drained soil is on alluvial fans. It formed in alluvium derived from mixed rock sources. The vegetation in areas not cultivated is mainly perennial grasses, shrubs, and forbs. Elevation is 2,000 to 3,500 feet. The average annual precipitation is about 18 inches, the average annual air temperature is about 50 degrees F, and the average frost-free period is about 125 days.

Typically, the surface layer is dark grayish brown gravelly loam about 15 inches thick. The subsoil is dark grayish brown gravelly clay loam and dark brown gravelly sandy clay loam about 37 inches thick. The substratum to a depth of 62 inches or more is brown gravelly sandy clay loam.

Included in this unit are small areas of a soil that is similar to this Dotta soil but is mildly alkaline throughout and is calcareous in a few places. Included areas make up about 15 percent of the total acreage.

Permeability of this Dotta soil is moderately slow. Available water capacity is low to moderate. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for cultivated crops, hay and pasture, rangeland, and homesite development. The main crops are irrigated and nonirrigated wheat and barley.

This unit is suited to crops commonly grown in the area. It is limited mainly by slope, the gravelly texture of the surface layer, and the hazard of erosion.

Furrow, corrugation, and sprinkler irrigation systems are suited to the soil in this unit. The method used generally is governed by the crop grown. If furrow irrigation systems are used, runs should be on the contour or across the slope. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crop needs.

Erosion can be reduced if fall grain is seeded early, stubble-mulch tillage is used, and tillage and seeding are on the contour or across the slope. Also, waterways should be shaped and seeded to perennial grass.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Gravel in the surface layer causes rapid wear of equipment used for tillage.

This unit is suited to hay and pasture. Proper grazing practices, weed control, and fertilizer are needed for maximum quality of forage.

This unit is suited to use as rangeland. It has few limitations. The soil in this unit responds well to fertilizer, to range seeding, and to proper grazing use.

The potential plant community on this unit includes bluebunch wheatgrass, beardless wheatgrass, Idaho fescue, western juniper, and buckbrush.

This unit is suited to homesite development. It has few limitations. Onsite sewage disposal systems may not

function properly because of the moderately slow permeability of the subsoil. Shrinking and swelling with alternate drying and wetting may be a problem in constructing buildings and roads.

Removal of pebbles and cobbles in disturbed areas is required for best results when landscaping, particularly in areas used for lawns. Mulching, fertilizing, and irrigating are needed to establish lawn grasses and other small seeded plants.

This map unit is in capability units IIe-4(21), irrigated, and IIIe-4(21), nonirrigated.

143—Dubakella-lpish complex, 5 to 30 percent slopes. This map unit is on mountains. The native vegetation is mainly mixed conifers, shrubs, perennial grasses, and forbs. Elevation is 2,500 to 5,000 feet. The average annual precipitation is about 35 inches, the average annual air temperature is about 48 degrees F, and the average frost-free period is about 125 days.

This unit is 40 percent Dubakella stony loam and 30 percent lpish gravelly clay loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of soils that are similar to the Dubakella soil but are underlain by serpentine rock at a depth of 10 to 20 inches, soils that formed in residuum derived from basic igneous rock, and soils that are gravelly throughout. Also included are small areas of Weitchpec Variant gravelly loam and Rock outcrop. Included areas make up about 30 percent of the total acreage.

The Dubakella soil is moderately deep and well drained. It formed in residuum derived dominantly from serpentine rock. Typically, the surface is covered with a mat of undecomposed and partially decomposed needles, leaves, twigs, bark, and other organic debris about 2 inches thick. The surface layer is pale brown stony loam about 11 inches thick. The subsoil is brown very gravelly clay loam about 25 inches thick. Bedrock is at a depth of 36 inches. A few stones are on the surface in most places.

Permeability of the Dubakella soil is slow. Available water capacity is very low to low. Effective rooting depth is 20 to 40 inches. Runoff is medium to rapid, and the hazard of water erosion is moderate to high.

The lpish soil is very deep and well drained. It formed in residuum derived dominantly from serpentine rock. Typically, the surface is covered with a mat of undecomposed and partially decomposed needles, leaves, twigs, bark, and other organic debris about 1/4 inch thick. The surface layer is dark brown gravelly loam about 2 inches thick. The upper part of the subsoil is dark brown gravelly clay loam about 42 inches thick. The lower part is dark brown very gravelly clay loam about 21 inches thick. Bedrock is at a depth of 65 inches.

Permeability of the lpish soil is moderately slow. Available water capacity is moderate. Effective rooting

depth is 60 to 80 inches. Runoff is medium to rapid, and the hazard of water erosion is moderate to high.

This unit is used as woodland and for livestock grazing.

This unit is poorly suited to use as woodland. It can produce about 1,180 cubic feet, or 5,250 board feet (Scribner rule), of timber per acre from a fully stocked stand of even-aged Jeffrey pine trees 80 years old.

The main concerns in producing and harvesting timber are the hazard of erosion and low fertility. Trees on the Dubakella soil are subject to windthrow. Spoil from excavations is subject to rill and gully erosion and to sloughing. Proper design of road drainage systems and care in the placement of culverts help to control erosion.

Jeffrey pine is a suitable tree to plant on this unit. Reforestation is limited mainly by low fertility.

When the density of the forest canopy is less than about 40 percent, this unit produces grazable understory. The understory includes manzanita, bottlebrush squirreltail, beardless wheatgrass, bluebunch wheatgrass, and Idaho fescue.

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

144—Dubakella-lpish complex, 30 to 50 percent slopes. This map unit is on mountains. The native vegetation is mainly mixed conifers, shrubs, perennial grasses, and forbs. Elevation is 2,500 to 5,000 feet. The average annual precipitation is about 35 inches, the average annual air temperature is about 48 degrees F, and the average frost-free period is about 125 days.

This unit is 40 percent Dubakella stony loam and 30 percent lpish gravelly clay loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of soils that are similar to this Dubakella soil but are underlain by serpentine at a depth of 10 to 20 inches, soils that formed in residuum of basic igneous rock, and a soil that is gravelly throughout. Also included are small areas of Weitchpec Variant gravelly loam and Rock outcrop. Included areas make up about 30 percent of the total acreage.

The Dubakella soil is moderately deep and well drained. It formed in residuum derived dominantly from serpentine rock. Typically, the surface is covered with a mat of undecomposed and partially decomposed needles, leaves, twigs, bark, and other organic debris about 2 inches thick. The surface layer is pale brown stony loam about 11 inches thick. The subsoil is brown very gravelly clay loam about 25 inches thick. Bedrock is at a depth of 36 inches. A few stones are on the surface in most places.

Permeability of the Dubakella soil is slow. Available water capacity is very low to low. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

The lpiish soil is very deep and well drained. It formed in residuum derived dominantly from serpentine. Typically, the surface is covered with a mat of undecomposed and partially decomposed needles, leaves, twigs, bark, and other organic debris about 1/4 inch thick. The surface layer is dark brown gravelly loam about 2 inches thick. The upper part of the subsoil is dark brown gravelly clay loam about 42 inches thick. The lower part is dark brown very gravelly clay loam about 21 inches thick. Bedrock is at a depth of 65 inches.

Permeability of the lpiish soil is moderately slow. Available water capacity is moderate. Effective rooting depth is 60 to 80 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used as woodland and for livestock grazing.

This unit is poorly suited to use as woodland. It can produce about 1,180 cubic feet, or 5,250 board feet (Scribner rule), of timber per acre from a fully stocked stand of even-aged Jeffrey pine trees 80 years old.

The main concerns in producing and harvesting timber are the hazard of erosion, slope, and low fertility. Trees on the Dubakella soil are subject to windthrow. Spoil from excavations is subject to rill and gully erosion and to sloughing. Proper design of road drainage systems and care in the placement of culverts help to control erosion. Conventional methods of harvesting trees are difficult to use because of the steepness of slope.

Jeffrey pine is a suitable tree to plant on this unit. Reforestation is limited mainly by low fertility.

When the density of the forest canopy is less than about 40 percent, this unit produces grazable understory. The understory includes manzanita, bottlebrush squirreltail, beardless wheatgrass, bluebunch wheatgrass, and Idaho fescue. Livestock grazing should be managed to protect the soil in this unit from excessive erosion.

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

145—Dumps. Dumps consists of uneven piles of waste rock from dredging operations. It is mainly on flood plains and in channels of the major streams in the survey area. Large areas are along the Scott River.

The hazards of erosion and deposition are very high, and the areas are subject to flooding under abnormal conditions. Without major reclamation, areas of this unit cannot support plants.

Included in this unit are small areas of Xerofluvents, Riverwash, Rock outcrop, and Rubble land. These included areas make up about 20 percent of the mapped acreage.

This unit is used for wildlife habitat and watershed.

This map unit is in capability subclass VIII(21), nonirrigated.

146—Duzel gravelly loam, 5 to 9 percent slopes.

This moderately deep, well drained soil is on mountains. It formed in residuum derived dominantly from metamorphosed rock. The native vegetation is mainly perennial grasses, shrubs, forbs, and scattered juniper. Elevation is 2,200 to 5,000 feet. The average annual precipitation is about 18 inches, the average annual air temperature is about 46 degrees F, and the average frost-free period is about 125 days.

Typically, the surface layer is dark brown gravelly loam about 13 inches thick. The upper 17 inches of the subsoil is dark brown and brown gravelly loam. The lower 8 inches is reddish brown very gravelly clay loam. Weathered rock is at a depth of 38 inches.

Included in this unit are small areas of Hilt sandy loam, Marpa gravelly loam, Facey loam, Jilson gravelly loam, Rock outcrop, and a soil that is similar to this Duzel soil but has slopes of as much as 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Duzel soil is moderately slow. Available water capacity is very low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as rangeland and for homesite development.

This unit is suited to use as rangeland. It has few limitations. The soil in this unit responds well to fertilizer, to range seeding, and to proper grazing use.

The potential plant community on this unit includes bluebunch wheatgrass, beardless wheatgrass, and western juniper.

This unit is suited to homesite development. The main limitations are moderately slow permeability and the gravelly texture of the surface layer. Removal of pebbles in disturbed areas is required for best results when landscaping, particularly in areas used for lawns. Mulching, fertilizing, and irrigating are needed to establish lawn grasses and other small seeded plants.

Because of limited soil depth and moderately slow permeability, onsite investigation is required to determine if an onsite waste disposal system will function properly.

This map unit is in capability unit IIIe-4(5), nonirrigated.

147—Duzel gravelly loam, 9 to 15 percent slopes.

This moderately deep, well drained soil is on mountains. It formed in residuum derived dominantly from metamorphosed rock. The native vegetation is mainly perennial grasses, shrubs, forbs, and scattered juniper. Elevation is 2,200 to 5,000 feet. The average annual precipitation is about 18 inches, the average annual air temperature is about 46 degrees F, and the average frost-free period is about 125 days.

Typically, the surface layer is dark brown gravelly loam about 13 inches thick. The upper 17 inches of the subsoil is dark brown and brown gravelly loam. The lower 8 inches is reddish brown very gravelly clay loam. Weathered rock is at a depth of 38 inches.

Included in this unit are small areas of Hilt sandy loam, Marpa gravelly loam, Facey loam, Rock outcrop, and a soil that is similar to this Duzel soil but has slopes of 15 to 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Duzel soil is moderately slow. Available water capacity is very low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as rangeland and for homesite development.

This unit is suited to use as rangeland. It has few limitations. The soil in this unit responds well to fertilizer, to range seeding, and to proper grazing use.

The potential plant community on this unit includes bluebunch wheatgrass, beardless wheatgrass, and western juniper.

This unit is suited to homesite development. The main limitations are depth to rock, moderately slow permeability, slope, and the gravelly texture of the surface layer. The deep cuts needed to provide essentially level building sites can expose bedrock. Erosion is a hazard in the steeper areas. Only the part of the site that is used for construction should be disturbed.

Removal of pebbles in disturbed areas is required for best results when landscaping, particularly in areas used for lawns. Mulching, fertilizing, and irrigating are needed to establish lawn grasses and other small seeded plants.

Because of limited soil depth, slope, and moderately slow permeability, onsite investigation is required to determine if an onsite waste disposal system will function properly.

This map unit is in capability unit IIIe-4(5), nonirrigated.

148—Duzel-Jilson-Facey complex, 15 to 50 percent slopes. This map unit is on mountains. The native vegetation is mainly mixed perennial grasses, shrubs, forbs, and juniper. Elevation is 2,200 to 5,000 feet. The average annual precipitation is about 18 inches, the average annual air temperature is about 46 degrees F, and the average frost-free period is about 125 days.

This unit is 40 percent Duzel gravelly loam, 30 percent Jilson gravelly loam, and 20 percent Facey loam.

Included in this unit are small areas of Hilt sandy loam, Rock outcrop, and Rubble land. Included areas make up about 10 percent of the total acreage.

The Duzel soil is moderately deep and well drained. It formed in residuum derived dominantly from metamorphosed rock. Typically, the surface layer is dark brown gravelly loam about 13 inches thick. The upper 17 inches of the subsoil is dark brown and brown gravelly loam. The lower 8 inches is reddish brown very gravelly clay loam. Weathered rock is at a depth of 38 inches.

Permeability of the Duzel soil is moderately slow. Available water capacity is very low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

The Jilson soil is shallow and well drained. It formed in residuum derived dominantly from metamorphosed rock. Typically, the surface layer is brown gravelly loam about 3 inches thick. The subsoil is brown and yellowish brown gravelly loam about 11 inches thick. Bedrock is at a depth of 14 inches.

Permeability of the Jilson soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is high.

The Facey soil is deep and well drained. It formed in residuum derived dominantly from metamorphosed rock. Typically, the surface layer is dark grayish brown and grayish brown loam about 10 inches thick. The subsoil is brown, yellowish brown, and very pale brown clay loam about 49 inches thick. Bedrock is at a depth of 59 inches.

Permeability of the Facey soil is moderately slow. Available water capacity is low to high. Effective rooting depth is 40 to 60 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used as rangeland.

This unit is suited to use as rangeland. The main limitations are slope and the hazard of erosion. The Jilson soil is also limited by shallow depth. Steepness of slope limits access by livestock and promotes overgrazing of the less sloping areas. Trails and walkways can be constructed in places to encourage livestock grazing in areas where access is limited. Range seeding is a suitable practice if the range vegetation is in poor condition. Livestock grazing should be managed to protect the unit from excessive erosion. Management practices suitable for use on this unit are proper range use, deferred grazing, and rotation grazing.

The potential plant community on the Duzel and Facey soils includes bluebunch wheatgrass, beardless wheatgrass, Idaho fescue, and western juniper. The potential plant community on the Jilson soil includes bottlebrush squirreltail, Thurber needlegrass, western juniper, and bluebunch wheatgrass.

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

149—Esro silt loam. This very deep, very poorly drained soil is in basins. It formed in alluvium derived from extrusive igneous rock. Slope is 0 to 2 percent. The native vegetation is mainly perennial grasses, sedges, and other water-tolerant plants. Elevation is 4,500 to 5,500 feet. The average annual precipitation is about 40 inches, the average annual air temperature is about 41 degrees F, and the average frost-free period is about 50 days.

Typically, the surface layer is dark gray and gray silt loam about 32 inches thick. The upper 14 inches of the underlying material is gray and light gray silt loam. The lower part to a depth of 79 inches or more is very pale

brown and light brownish gray sandy loam and light brownish gray sandy clay loam.

Included in this unit are small areas of sandy loam and gravelly loam overwash 10 to 15 inches thick. Included areas make up about 10 percent of the total acreage.

Permeability of this Esro soil is moderately slow. Available water capacity is high to very high. Effective rooting depth is 60 inches or more. Runoff is very slow. A seasonal high water table is at a depth of 0 to 12 inches from December through August. This soil is subject to very long periods of flooding from January through June.

This unit is used as rangeland.

This unit is suited to use as rangeland. The production of vegetation suitable for livestock grazing is limited by the high water table and the hazard of flooding. The soil in this unit responds well to fertilizer, to range seeding, and to proper grazing use. Plants that tolerate wetness should be seeded. Such plants must be able to withstand long periods of inundation. Grazing should be delayed until the soil is firm and the more desirable forage plants have achieved sufficient growth to withstand grazing pressure.

The potential plant community on this unit includes tufted hairgrass, clover, and northern mannagrass.

This map unit is in capability subclass Vw(22), nonirrigated.

150—Esro silt loam, drained. This very deep, very poorly drained soil is in basins. It formed in alluvium derived from extrusive igneous rock. Slope is 0 to 2 percent. The native vegetation is mainly perennial grasses, sedges, and other water-tolerant plants. Elevation is 4,500 to 5,500 feet. The average annual precipitation is about 40 inches, the average annual air temperature is about 41 degrees F, and the average frost-free period is about 50 days.

Typically, the surface layer is dark gray and gray silt loam about 32 inches thick. The upper 14 inches of the underlying material is gray and light gray silt loam. The lower part to a depth of 79 inches or more is very pale brown and light brownish gray sandy loam and light brownish gray sandy clay loam.

Included in this unit are small areas of gravelly sandy loam, silt overwash about 10 to 15 inches thick, and a soil that is similar to this Esro soil but has slopes of as much as 5 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Esro soil is moderately slow. Available water capacity is high to very high. Effective rooting depth is 60 inches or more. Runoff is very slow. A seasonal high water table fluctuates between depths of 24 and 48 inches from December through July. This soil is subject to rare periods of flooding.

This unit is used as rangeland.

This unit is suited to use as rangeland. The production of vegetation suitable for livestock grazing is limited by

the seasonal high water table. The soil in this unit responds well to fertilizer, to range seeding, and to proper grazing use. Plants that tolerate wetness should be seeded. Grazing should be delayed until the soil is firm and the more desirable forage plants have achieved sufficient growth to withstand grazing pressure.

The potential plant community on this unit includes tufted hairgrass, clover, and northern mannagrass.

This map unit is in capability unit IVw-2(22), nonirrigated.

151—Etsel very gravelly loam, 30 to 75 percent slopes. This very shallow, somewhat excessively drained soil is on mountains. It formed in residuum derived dominantly from metamorphosed rock. The native vegetation is mainly brush. Elevation is 2,500 to 5,000 feet. The average annual precipitation is about 35 inches, the average annual air temperature is about 50 degrees F, and the average frost-free period is about 125 days.

Typically, the surface is covered with a mat of undecomposed and partially decomposed needles, leaves, twigs, bark, and other organic debris about 2 inches thick. The surface layer is pale brown very gravelly loam about 7 inches deep over fractured bedrock.

Included in this unit are small areas of a soil that is similar to this Etsel soil but is underlain by bedrock at a depth of 10 to 20 inches, Neuns gravelly loam, Kindig gravelly loam, Kinkel very gravelly loam, a soil that has slopes of 2 to 15 percent, and Rock outcrop. Included areas make up about 25 percent of the total acreage.

Permeability of this Etsel soil is moderate. Available water capacity is very low. Effective rooting depth is 6 to 10 inches. Runoff is very rapid, and the hazard of water erosion is very high.

This unit is used as rangeland.

This unit is poorly suited to use as rangeland. The production of vegetation suitable for livestock grazing is limited by shallow soil depth, very low available water capacity, and the hazard of erosion. The soil in this unit has a strong tendency to support brush. If the brush is managed to create open areas, the soil produces a stand of desirable grasses and forbs. Steepness of slope limits access by livestock and promotes overgrazing of the less sloping areas. Trails or walkways can be constructed in places to encourage livestock grazing in areas where access is limited.

Livestock grazing should be managed to protect the soil from excessive erosion. Management practices suitable for use on this unit are proper range use, deferred grazing, rotation grazing, and brush management.

The potential plant community on this unit includes mountain brome, ceanothus, and manzanita.

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

152—Facey loam, 5 to 15 percent slopes. This deep, well drained soil is on toe slopes of mountains. It formed in colluvium derived dominantly from metamorphosed rock. The native vegetation is mainly perennial grasses, shrubs, forbs, and a few scattered juniper trees. Elevation is 2,500 to 5,000 feet. The average annual precipitation is about 18 inches, the average annual air temperature is about 46 degrees F, and the average frost-free period is about 125 days.

Typically, the surface layer is dark grayish brown and grayish brown loam about 10 inches thick. The subsoil is brown, yellowish brown, and very pale brown clay loam about 49 inches thick. Bedrock is at a depth of 59 inches.

Included in this unit are small areas of Bonnet soils that have slopes of 5 to 15 percent, Jilson gravelly loam, and a soil that is similar to this Facey soil but has bedrock at a depth of more than 60 inches. Also included are a few areas of soils that have slopes of 15 to 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Facey soil is moderately slow. Available water capacity is low to high. Effective rooting depth is 40 to 60 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for cultivated crops, hay and pasture, rangeland, and homesite development. The main crops are irrigated and nonirrigated wheat and barley.

This unit is suited to crops commonly grown in the area. It is limited mainly by slope. Sprinkler or contour ditch irrigation is suited to the unit. The method used generally is governed by the crop grown. Pipe, ditch lining, or drop structures should be installed in irrigation ditches to facilitate irrigation and prevent excessive ditch erosion. Irrigation water should be applied at a rate that insures optimum production without increasing runoff, deep percolation, and erosion.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. All tillage should be on the contour or across the slope.

This unit is suited to hay and pasture. It has few limitations. Proper grazing practices, weed control, and fertilizer are needed for maximum quality of forage. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff.

This unit is suited to use as rangeland. It has few limitations. The soil in this unit responds well to fertilizer, to range seeding, and to proper grazing use. Grazing should be delayed until the soil has drained sufficiently and is firm enough to withstand trampling by livestock. If the shrubs are managed to create open areas, the soil produces a good stand of desirable grasses and forbs.

The potential plant community on this unit includes bottlebrush squirreltail, Thurber needlegrass, Idaho fescue, bluebunch wheatgrass, and beardless wheatgrass.

This unit is suited to homesite development. The main limitations are load supporting capacity, shrink-swell potential, moderately slow permeability, and slope. Only the part of the site that is used for construction should be disturbed. Plans for homesite development should provide for the preservation of as many trees as possible. Establishing and maintaining plant cover can be achieved through proper fertilizing, seeding, mulching, and shaping of the slopes.

If this unit is used for septic tank absorption fields, the limitation of moderately slow permeability can be overcome by increasing the size of the absorption field. The steepness of slope is a concern in installing absorption fields. Absorption lines should be installed on the contour.

If buildings are constructed on the soil in this unit, properly designing foundations and footings and diverting runoff away from buildings help to prevent structural damage as a result of shrinking and swelling. Buildings and roads should be designed to offset the limited ability of the soil to support a load.

This map unit is in capability unit IIIe-1(21), irrigated and nonirrigated.

153—Gazelle silt loam. This very poorly drained soil is in basins. It is moderately deep to a hardpan. The soil formed in alluvium derived from mixed rock sources and is slightly affected by salts. Slope is 0 to 2 percent. The vegetation in areas not cultivated is mainly salt-tolerant grasses, shrubs, and forbs. Elevation is 2,500 to 3,500 feet. The average annual precipitation is about 13 inches, the average annual air temperature is about 50 degrees F, and the average frost-free period is about 125 days.

Typically, the surface layer is light brownish gray and light gray, strongly alkaline silt loam about 11 inches thick. The upper 14 inches of the underlying material is white silt loam. The next 13 inches is a white, strongly cemented hardpan. The lower part to a depth of 60 inches or more is white silt loam. In some areas the surface layer is sandy loam.

Included in this unit are small areas of Montague clay and Salisbury clay loam. Also included are a few areas of soils that are similar to this Gazelle soil but are free of salts or are moderately affected by salts and contain sodium. Included areas make up about 15 percent of the total acreage.

Permeability of this Gazelle soil is moderately rapid above the hardpan. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is very slow. A seasonal high water table is at a depth of 0 to 18 inches from December through March. This soil is subject to long periods of flooding from November through May.

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

This unit is suited to hay and pasture. The main limitations are slight salinity, depth to the hardpan, the seasonal high water table, and the hazard of flooding.

The concentration of salts in the surface layer limits the production of plants suitable for hay and pasture. Leaching the salts from the surface layer is limited by the high water table; however, the concentration of salts can be reduced if drainage is provided and an adequate irrigation water management program is followed. Sprinkler irrigation is the most suitable method of applying water. Salt-tolerant species are most suitable for planting.

The hardpan can be ripped and shattered. This increases the effective rooting depth and improves internal drainage.

Proper grazing practices, weed control, and fertilizer are needed for maximum quality of forage. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff.

This unit is suited to use as rangeland. The main limitations are the seasonal high water table and slight salinity. The soil in this unit responds well to range seeding and to proper grazing use. Plants that tolerate wetness and slight salinity should be seeded. Grazing should be delayed until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.

The potential plant community on this unit includes inland saltgrass, carex, and rush.

This unit is poorly suited to homesite development. The main limitations are salinity, the hazard of flooding, depth to the hardpan, and the seasonal high water table. Plants that tolerate a high water table and slight salinity should be selected to establish lawns, shrubs, trees, and vegetable gardens. Drainage is needed for best results with most lawn grasses, shade trees, ornamental trees, shrubs, vines, and vegetable gardens.

Drainage is needed if roads and building foundations are constructed. Flooding can be controlled only by use of major flood control structures. The hardpan is rippable and therefore is not a serious limitation for most engineering uses.

Onsite sewage disposal systems often fail or do not function properly during periods of high rainfall because of the hardpan. The high water table increases the possibility of failure of septic tank absorption fields.

This map unit is in capability subclass Vw(21), irrigated and nonirrigated.

154—Gazelle Variant sandy clay loam. This very poorly drained soil is in basins. It is shallow to a hardpan. The soil formed in alluvium derived from mixed rock sources. It is slightly affected by salts. Slope is 0 to 2 percent. The vegetation in areas not cultivated is mainly salt-tolerant grasses, shrubs, and forbs. Elevation is 2,500 to 3,500 feet. The average annual precipitation is about 13 inches, the average annual air temperature is

about 50 degrees F, and the average frost-free period is about 125 days.

Typically, the surface layer is light brownish gray sandy clay loam about 12 inches thick. The next layer is a light brownish gray and dark grayish brown, moderately cemented hardpan about 6 inches thick. The underlying material to a depth of 60 inches or more is white silt loam.

Included in this unit are small areas of Montague clay and Salisbury clay loam. Also included are a few areas of soils that are similar to this Gazelle Variant soil but are free of salts or are moderately or strongly affected by salts and contain sodium in places. Included areas make up about 15 percent of the total acreage.

Permeability of this Gazelle Variant soil is moderately slow above the hardpan. Available water capacity is very low to low. Effective rooting depth is 10 to 20 inches. Runoff is very slow. A seasonal high water table is at a depth of 0 to 12 inches from December through April. This soil is subject to brief periods of flooding in December and January.

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

This unit is poorly suited to irrigated and nonirrigated hay and pasture. The main limitations are salinity, depth to the hardpan, the seasonal high water table, and the hazard of flooding. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff.

The concentration of salts in the surface layer limits the production of plants suitable for hay and pasture. Leaching the salts from the surface layer is limited by the high water table. However, the concentration of salts can be reduced if drainage is provided and an irrigation water management program is followed. Salt-tolerant species are most suitable for planting.

The hardpan can be ripped and shattered. This increases the effective rooting depth and improves internal drainage.

This unit is suited to use as rangeland. The main limitations are the seasonal high water table, salinity, and the hazard of flooding. The soil in this unit responds well to range seeding and to proper grazing use. Plants that tolerate wetness and salinity should be seeded. Grazing should be delayed until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.

The potential plant community on this unit includes inland saltgrass, carex, and rush.

This unit is poorly suited to homesite development. The main limitations are salinity, the hazard of flooding, depth to the hardpan, and the seasonal high water table. Plants that tolerate a high water table and slight salinity should be selected to establish lawns, shrubs, trees, and vegetable gardens. Drainage is needed for best results with most lawn grasses, shade trees, ornamental trees, shrubs, vines, and vegetable gardens.

Drainage is needed if roads and building foundations are constructed. Flooding can be controlled only by use of major flood control structures. The hardpan is rippable and therefore is not a serious limitation for most engineering uses.

Onsite sewage disposal systems often fail or do not function properly during periods of high rainfall because of the hardpan. The high water table increases the possibility of failure of septic tank absorption fields.

This map unit is in capability subclass Vlw(21), irrigated and nonirrigated.

155—Hilt sandy loam, 2 to 15 percent slopes. This moderately deep, well drained soil is on hills. It formed in residuum derived dominantly from sandstone. The native vegetation is mainly perennial grasses, shrubs, and forbs. Elevation is 2,000 to 3,500 feet. The average annual precipitation is about 18 inches, the average annual air temperature is about 50 degrees F, and the average frost-free period is about 125 days.

Typically, the surface layer is dark brown and brown sandy loam about 11 inches thick. The subsoil is dark brown and yellowish red sandy clay loam about 27 inches thick. Weathered rock is at a depth of 38 inches. Unweathered bedrock is at a depth of 47 inches.

Included in this unit are small areas of Kinkel very gravelly loam, soils that have been subject to severe sheet erosion, Rock outcrop, and a soil that is similar to this Hilt soil but has slopes of as much as 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Hilt soil is moderately slow. Available water capacity is very low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for nonirrigated cultivated crops and as rangeland.

This unit is suited to nonirrigated wheat and barley. It is limited mainly by slope and the hazard of erosion. Erosion can be reduced if fall grain is seeded early, stubble-mulch tillage is used, and tillage and seeding are on the contour or across the slope. Also, waterways should be shaped and seeded to perennial grass. Limiting tillage for seedbed preparation and weed control reduces runoff and erosion. Tillage and fertility can be improved by returning crop residue to the soil.

This unit is suited to use as rangeland. It has few limitations. The soil in this unit responds well to fertilizer, to range seeding, and to proper grazing use. Grazing should be delayed until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.

The potential plant community on this unit includes bottlebrush squirreltail, Thurber needlegrass, Idaho fescue, and rubber rabbitbrush.

This map unit is in capability unit IIIe-1(21), nonirrigated.

156—Hilt sandy loam, 15 to 30 percent slopes. This moderately deep, well drained soil is on hills. It formed in residuum derived dominantly from sandstone. The native vegetation is mainly perennial grasses, shrubs, and forbs. Elevation is 2,000 to 3,500 feet. The average annual precipitation is about 18 inches, the average annual air temperature is about 50 degrees F, and the average frost-free period is about 125 days.

Typically, the surface layer is dark brown and brown sandy loam about 11 inches thick. The subsoil is dark brown and yellowish red sandy clay loam about 27 inches thick. Weathered rock is at a depth of 38 inches. Unweathered bedrock is at a depth of 47 inches.

Included in this unit are small areas of Kinkel very gravelly loam, Terwilliger silty clay loam, and Rock outcrop. Included areas make up about 15 percent of the total acreage.

Permeability of this Hilt soil is moderately slow. Available water capacity is very low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for nonirrigated cultivated crops and as rangeland.

This unit is suited to nonirrigated wheat and barley. It is limited mainly by slope and the hazard of erosion. Erosion can be reduced if fall grain is seeded early, stubble-mulch tillage is used, and tillage and seeding are on the contour or across the slope. Also, waterways should be shaped and seeded to perennial grass. Limiting tillage for seedbed preparation and weed control reduces runoff and erosion. Tillage and fertility can be improved by returning crop residue to the soil.

This unit is suited to use as rangeland. It has few limitations. The soil in this unit responds well to fertilizer, to range seeding, and to proper grazing use. Grazing should be delayed until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.

The potential plant community on this unit includes bottlebrush squirreltail, Thurber needlegrass, Idaho fescue, and rubber rabbitbrush.

This map unit is in capability unit IVe-1(21), nonirrigated.

157—Hilt stony sandy loam, 2 to 50 percent slopes. This moderately deep, well drained soil is on hills. It formed in residuum derived dominantly from sandstone. The native vegetation is mainly perennial grasses, shrubs, and forbs. Elevation is 2,000 to 3,500 feet. The average annual precipitation is about 18 inches, the average annual air temperature is about 50 degrees F, and the average frost-free period is about 125 days.

Typically, the surface layer is dark brown and brown stony sandy loam about 11 inches thick. The subsoil is dark brown and yellowish red sandy clay loam about 27 inches thick. Weathered rock is at a depth of 38 inches.

Unweathered bedrock is at a depth of 47 inches. A few stones are on the surface in most places.

Included in this unit are small areas of Jilson gravelly loam, Terwilliger silty clay loam, Rubble land, and Rock outcrop. Included areas make up about 20 percent of the total acreage.

Permeability of this Hilt soil is moderately slow. Available water capacity is very low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is medium to rapid, and the hazard of water erosion is moderate to high.

This unit is used as rangeland.

This unit is suited to use as rangeland. The production of vegetation suitable for livestock grazing is limited by slope and the hazard of erosion. Livestock grazing should be managed to protect the unit from excessive erosion.

Management practices suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. Steepness of slope limits access by livestock and promotes overgrazing of the less sloping areas. Trails or walkways can be constructed in places to encourage livestock grazing in areas where access is limited. Grazing should be delayed until the soil in the unit is firm and the more desirable forage plants have achieved sufficient growth to withstand grazing pressure.

The potential plant community on this unit includes Idaho fescue, beardless wheatgrass, bluebunch wheatgrass, and ceanothus.

This map unit is in capability subclass VIe(21), nonirrigated.

158—Hilt-Rock outcrop complex, 2 to 50 percent slopes. This map unit is on hills. The native vegetation is mainly perennial grasses, shrubs, and forbs. Elevation is 2,000 to 3,500 feet. The average annual precipitation is about 18 inches, the average annual air temperature is about 50 degrees F, and the average frost-free period is about 125 days.

This unit is 45 percent Hilt stony sandy loam and 35 percent Rock outcrop. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Jilson gravelly loam, Terwilliger silty clay loam, and Rubble land. Included areas make up about 20 percent of the total acreage.

The Hilt soil is moderately deep and well drained. It formed in residuum derived dominantly from sandstone. Typically, the surface layer is dark brown and brown stony sandy loam about 11 inches thick. The subsoil is dark brown and yellowish red sandy clay loam about 27 inches thick. Weathered rock is at a depth of 38 inches. Unweathered bedrock is at a depth of 47 inches. A few stones are on the surface in most places.

Permeability of the Hilt soil is moderately slow. Available water capacity is very low to moderate.

Effective rooting depth is 20 to 40 inches. Runoff is medium to rapid, and the hazard of water erosion is moderate to high.

Rock outcrop consists of exposures of bare bedrock. This unit is used as rangeland.

This unit is suited to use as rangeland. The production of vegetation suitable for livestock grazing is limited mainly by slope, the hazard of erosion, and the areas of Rock outcrop. Use of mechanical treatment practices is not practical, because of the areas of Rock outcrop. Livestock grazing should be managed to protect the unit from excessive erosion.

Management practices suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. Steepness of slope limits access by livestock and promotes overgrazing of the less sloping areas. Trails can be constructed in places to encourage livestock grazing in areas where access is limited. Grazing should be delayed until the soil in the unit is firm and the more desirable forage plants have achieved sufficient growth to withstand grazing pressure.

The potential plant community on this unit includes Idaho fescue, beardless wheatgrass, bluebunch wheatgrass, and ceanothus.

This map unit is in capability subclass VIIe(21), nonirrigated.

159—Jenny clay, 0 to 2 percent slopes. This very deep, well drained soil is on terraces. It formed in alluvium derived dominantly from extrusive igneous rock. The vegetation in areas not cultivated is mainly perennial grasses, shrubs, and forbs. Elevation is 2,500 to 5,000 feet. The average annual precipitation is about 13 inches, the average annual air temperature is about 50 degrees F, and the average frost-free period is about 125 days.

Typically, the surface layer is dark gray clay about 16 inches thick. The upper 7 inches of the underlying material is dark grayish brown clay. The lower part to a depth of 60 inches or more is brown clay loam and mixed light brownish gray and white loam. The lower part of the underlying material is calcareous.

Included in this unit are small areas of Lassen clay that has slopes of 0 to 2 percent, Pit clay in small basins, and Medford clay loam on fans. Included areas make up about 15 percent of the total acreage.

Permeability of this Jenny soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for cultivated crops, hay and pasture, rangeland, and homesite development.

This unit is suited to irrigated and nonirrigated wheat and barley. It is limited mainly by fine texture and slow permeability. If the unit is dryfarmed, precipitation is not sufficient for annual cropping; thus, a cropping system that includes small grain and summer fallow is most

suitable. Tillage should be performed when the moisture content is about 50 percent of field capacity.

Returning crop residue to the soil or regularly adding other organic matter improves fertility, reduces crusting, and increases the water intake rate. Tillage should be kept to a minimum.

Furrow, border, corrugation, and sprinkler irrigation systems are suited to the soil in this unit. Because of the slow permeability of the soil, the application of water should be regulated so that water does not stand on the surface and damage the crops.

This unit is suited to hay and pasture. The main limitations are shrink-swell potential and susceptibility of the soil to compaction. Plants that tolerate shrinking and swelling should be seeded. Proper grazing practices, weed control, and fertilizer are needed for maximum quality of forage. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff.

This unit is suited to use as rangeland. The production of vegetation suitable for livestock grazing is limited by shrink-swell potential and susceptibility of the soil to compaction. The soil in this unit responds well to fertilizer, to range seeding, and to proper grazing use. Grazing should be delayed until the soil has drained sufficiently and is firm enough to withstand trampling by livestock. Plants that tolerate shrinking and swelling should be seeded.

The potential plant community on this unit includes bluebunch wheatgrass, Idaho fescue, sheep fescue, bulbous bluegrass, and sulphurflower.

This unit is suited to homesite development. The main limitations are shrink-swell potential, load supporting capacity, and slow permeability. If buildings are constructed on the soil in this unit, properly designing foundations and footings and diverting runoff away from buildings help to prevent structural damage as a result of shrinking and swelling. Buildings and roads should be designed to offset the limited ability of the soil to support a load.

Septic tank absorption fields do not function properly during rainy periods because of the slow permeability. This limitation can be overcome by increasing the size of the absorption field.

This map unit is in capability units IIs-5(21), irrigated, and IIIs-5(21), nonirrigated.

160—Jenny clay, 2 to 15 percent slopes. This very deep, well drained soil is on terraces. It formed in alluvium derived dominantly from extrusive igneous rock. The vegetation in areas not cultivated is mainly perennial grasses, shrubs, and forbs. Elevation is 2,500 to 5,000 feet. The average annual precipitation is about 13 inches, the average annual air temperature is about 50 degrees F, and the average frost-free period is about 125 days.

Typically, the surface layer is dark gray clay about 16 inches thick. The upper 7 inches of the underlying material is dark grayish brown clay. The lower part to a depth of 60 inches or more is brown clay loam and mixed light brownish gray and white loam. The lower part of the underlying material is calcareous.

Included in this unit are small areas of Kuck clay loam and Lassen clay on hills and Medford clay loam on alluvial fans. Included areas make up about 15 percent of the total acreage.

Permeability of this Jenny soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for cultivated crops, hay and pasture, rangeland, and homesite development.

This unit is suited to irrigated and nonirrigated wheat and barley. It is limited mainly by slope, the hazard of erosion, slow permeability, and fine soil texture. If the unit is dryfarmed, precipitation is not sufficient for annual cropping; thus, a cropping system that includes small grain and summer fallow is most suitable. Tillage should be performed when the moisture content is about 50 percent of field capacity.

Because of the slope and slow permeability of the soil in this unit, sprinkler or contour ditch irrigation is the most suitable method of applying water. Irrigation water should be applied at a rate that insures optimum production without increasing runoff, deep percolation, and erosion.

Erosion can be reduced if fall grain is seeded early, stubble-mulch tillage is used, and tillage and seeding are on the contour or across the slope. Also, waterways should be shaped and seeded to perennial grass. Returning crop residue to the soil or regularly adding other organic matter improves fertility, reduces crusting, and increases the water intake rate. Tillage should be kept to a minimum.

This unit is suited to hay and pasture. The main limitations are shrink-swell potential and the susceptibility of the soil to compaction. Plants that tolerate shrinking and swelling should be seeded. Grazing should be delayed until the soil has dried sufficiently and is firm enough to withstand trampling by livestock. Proper grazing practices, weed control, and fertilizer are needed for maximum quality of forage. Use of nitrogen and phosphorus fertilizer promotes good growth of forage plants.

This unit is suited to use as rangeland. The production of vegetation suitable for livestock grazing is limited by the shrink-swell potential and the susceptibility of the soil to compaction. The soil in this unit responds well to fertilizer, to range seeding, and to proper grazing use. Grazing should be delayed until the soil has drained sufficiently and is firm enough to withstand trampling by livestock. Plants that tolerate shrinking and swelling should be seeded.

The potential plant community on this unit includes bluebunch wheatgrass, Idaho fescue, sheep fescue, bulbous bluegrass, and sulphurflower.

This unit is suited to homesite development. The main limitations are the shrink-swell potential, load supporting capacity, slow permeability, slope, and the hazard of erosion, especially in the steeper areas.

If buildings are constructed on the soil in this unit, properly designing foundations and footings and diverting runoff away from buildings help to prevent structural damage as a result of shrinking and swelling. Structures to divert runoff are also needed if roads are constructed. Buildings and roads should be designed to offset the limited ability of the soil to support a load.

If septic tank sewage disposal systems are used, the limitation of slow permeability can be overcome by increasing the size of the absorption field.

Only the part of the site that is used for construction should be disturbed. Preserving the existing plant cover during construction helps to control erosion.

This map unit is in capability unit IIIe-5(21), irrigated and nonirrigated.

161—Jenny cobbly clay, 0 to 15 percent slopes.

This very deep, well drained soil is on terraces. It formed in alluvium derived dominantly from extrusive igneous rock. The vegetation in areas not cultivated is mainly perennial grasses, shrubs, and forbs. Elevation is 2,500 to 5,000 feet. The average annual precipitation is about 13 inches, the average annual air temperature is about 50 degrees F, and the average frost-free period is about 125 days.

Typically, the surface layer is dark gray cobbly clay about 16 inches thick. The upper 7 inches of the underlying material is dark grayish brown clay. The lower part to a depth of 60 inches or more is brown clay loam and mixed light brownish gray and white loam. The lower part of the underlying material is calcareous. A few cobbles are on the surface in most places.

Included in this unit are small areas of Kuck clay loam and Lassen clay on hills. Also included are small areas of Medford clay loam, on fans, that has slopes of more than 15 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Jenny soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow to medium, and the hazard of water erosion is slight to moderate.

This unit is used for cultivated crops, hay and pasture, rangeland, and homesite development.

This unit is suited to irrigated and nonirrigated wheat and barley if the cobbles are removed from the surface. It is limited mainly by the hazard of erosion, cobbles, fine soil texture, and slow permeability. If the unit is dryfarmed, precipitation is not sufficient for annual cropping; thus, a cropping system that includes small grain and summer fallow is most suitable. Tillage should

be performed when the moisture content is about 50 percent of field capacity.

Because of the slope and slow permeability, sprinkler, contour ditch, border, or corrugation irrigation is best suited to the soil in this unit. Irrigation water should be applied at a rate that insures optimum production without increasing runoff, deep percolation, and erosion.

Erosion can be reduced if fall grain is seeded early, stubble-mulch tillage is used, and tillage and seeding are on the contour or across the slope. Also, waterways should be shaped and seeded to perennial grass. Returning crop residue to the soil or regularly adding other organic matter improves fertility, reduces crusting, and increases the water intake rate. Tillage should be kept to a minimum. The use of equipment is limited by the cobbles on the surface.

This unit is suited to hay and pasture. The main limitations are shrink-swell potential and susceptibility of the soil to compaction. Plants that tolerate shrinking and swelling should be seeded. Grazing should be delayed until the soil has dried sufficiently and is firm enough to withstand trampling by livestock. Proper grazing practices, weed control, and fertilizer are needed for maximum quality of forage. Use of nitrogen and phosphorus fertilizer promotes good growth of forage plants.

This unit is suited to use as rangeland. The production of vegetation suitable for livestock grazing is limited by shrink-swell potential and susceptibility of the soil to compaction. The soil in this unit responds well to fertilizer, to range seeding, and to proper grazing use. Grazing should be delayed until the soil has drained sufficiently and is firm enough to withstand trampling by livestock. Plants that tolerate shrinking and swelling should be seeded.

The potential plant community on this unit includes bluebunch wheatgrass, bottlebrush squirreltail, Idaho fescue, and western juniper.

This unit is suited to homesite development. The main limitations are the shrink-swell potential, load supporting capacity, slow permeability, slope, and the hazard of erosion, which is greater in the steeper areas.

If buildings are constructed on the soil in this unit, properly designing foundations and footings and diverting runoff away from buildings help to prevent structural damage as a result of shrinking and swelling. Structures to divert runoff also are needed if roads are constructed. Buildings and roads should be designed to offset the limited ability of the soil to support a load.

If septic tank absorption fields are used, the limitation of slow permeability can be overcome by increasing the size of the absorption field.

Preserving the existing plant cover during construction helps to control erosion. Only the part of the site that is used for construction should be disturbed. Removal of pebbles and cobbles in disturbed areas is required for best results when landscaping, particularly in areas used

for lawns. Mulching, fertilizing, and irrigating are needed to establish lawn grasses and other small seeded plants.

This map unit is in capability unit IIIe-5(21), irrigated and nonirrigated.

162—Jilson gravelly loam, 50 to 65 percent slopes.

This shallow, well drained soil is on mountains. It formed in residuum derived dominantly from metamorphosed rock. The native vegetation is mainly perennial grasses, shrubs, forbs, and juniper trees. Elevation is 2,500 to 5,000 feet. The average annual precipitation is about 18 inches, the average annual air temperature is about 46 degrees F, and the average frost-free period is about 125 days.

Typically, the surface layer is brown gravelly loam about 3 inches thick. The subsoil is brown and yellowish brown gravelly loam about 11 inches thick. Fractured bedrock is at a depth of 14 inches.

Included in this unit are small areas of Rubble land and Rock outcrop. Included areas make up about 20 percent of the total acreage.

Permeability of this Jilson soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is very rapid, and the hazard of water erosion is very high.

This unit is used as rangeland.

This unit is poorly suited to use as rangeland. The production of vegetation suitable for livestock grazing is limited by slope, the hazard of erosion, shallow soil depth, and very low available water capacity. The suitability of this unit for rangeland seeding is limited by the steepness of slope. Livestock grazing should be managed to protect the soil from excessive erosion.

Management practices suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. Steepness of slope limits access by livestock and promotes overgrazing of the less sloping areas. Trails or walkways can be constructed in places to encourage livestock grazing in areas where access is limited.

The potential plant community on this unit includes bottlebrush squirreltail, cheatgrass, Thurber needlegrass, western juniper, and bluebunch wheatgrass.

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

163—Jilson-Duzel gravelly loams, 5 to 50 percent slopes.

This map unit is on mountains. The native vegetation is mainly perennial grasses, shrubs, forbs, and juniper trees. Elevation is 2,200 to 5,000 feet. The average annual precipitation is about 18 inches, the average annual air temperature is about 46 degrees F, and the average frost-free period is about 125 days.

This unit is 35 percent Jilson gravelly loam and 30 percent Duzel gravelly loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are about 20 percent Rock outcrop, 15 percent Facey loam, and a few small areas of Marpa gravelly loam. Included areas make up about 35 percent of the total acreage.

The Jilson soil is shallow and well drained. It formed in residuum derived dominantly from metamorphosed rock. Typically, the surface layer is brown gravelly loam about 3 inches thick. The subsoil is brown and yellowish brown gravelly loam about 11 inches thick. Fractured bedrock is at a depth of 14 inches.

Permeability of the Jilson soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is medium to rapid, and the hazard of water erosion is moderate to high.

The Duzel soil is moderately deep and well drained. It formed in residuum derived dominantly from metamorphosed rock. Typically, the surface layer is dark brown gravelly loam about 13 inches thick. The upper 17 inches of the subsoil is dark brown and brown gravelly loam. The lower part is reddish brown very gravelly clay loam about 8 inches thick. Weathered rock is at a depth of 38 inches.

Permeability of the Duzel soil is moderately slow. Available water capacity is very low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is medium to rapid, and the hazard of water erosion is moderate to high.

This unit is used as rangeland.

This unit is suited to use as rangeland. The production of vegetation suitable for livestock grazing is limited by slope and the hazard of erosion. Shallow rooting depth is also a limitation on the Jilson soil.

Steepness of slope limits access by livestock and promotes overgrazing of the less sloping areas. Trails or walkways can be constructed in places to encourage livestock grazing in areas where access is limited.

Livestock grazing should be managed to protect the soils in this unit from excessive erosion. Management practices suitable for use on these soils are proper range use, deferred grazing, and rotation grazing.

The potential plant community on the Jilson soil includes bottlebrush squirreltail, cheatgrass, Thurber needlegrass, western juniper, and bluebunch wheatgrass. On the Duzel soil it includes bluebunch wheatgrass, beardless wheatgrass, and western juniper.

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

164—Kindig-Neuns gravelly loams, 15 to 50 percent slopes.

This map unit is on mountains. The native vegetation is mainly mixed conifers, shrubs, perennial grasses, and forbs. Elevation is 2,500 to 6,000 feet. The average annual precipitation is about 35 inches, the average annual air temperature is about 48 degrees F, and the average frost-free period is 100 to 125 days.

This unit is 45 percent Kindig gravelly loam and 30 percent Neuns gravelly loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are about 15 percent Rock outcrop and 10 percent Etsel very gravelly loam that has slopes of as much as 75 percent, a Marpa soil that has a loam surface layer, and a soil that is similar to the Kindig soil but is more than 60 inches deep to bedrock. Included areas make up about 25 percent of the total acreage.

The Kindig soil is deep and well drained. It formed in residuum derived dominantly from metamorphosed rock. Typically, the surface is covered with a mat of undecomposed and partially decomposed needles, leaves, twigs, bark, and other organic debris about 2 inches thick. The surface layer is brown gravelly loam about 5 inches thick. The upper part of the subsoil is pale brown gravelly loam about 10 inches thick. The lower part is light yellowish brown very gravelly loam about 45 inches thick. Weathered rock is at a depth of 60 inches.

Permeability of the Kindig soil is moderate. Available water capacity is low to moderate. Effective rooting depth is 40 to 60 inches. Runoff is rapid, and the hazard of water erosion is high.

The Neuns soil is moderately deep and well drained. It formed in residuum derived dominantly from metamorphosed rock. Typically, the surface is covered with a mat of undecomposed and partially decomposed needles, leaves, twigs, bark, and other organic debris about 2 inches thick. The surface layer is dark brown and light yellowish brown gravelly loam about 8 inches thick. The subsoil is yellowish brown and pale brown very gravelly loam about 27 inches thick. Fractured bedrock is at a depth of 35 inches.

Permeability of the Neuns soil is moderate. Available water capacity is very low to low. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used as woodland and for livestock grazing.

This unit is moderately suited to the production of ponderosa pine, Douglas-fir, and sugar pine. The Kindig soil can produce about 9,124 cubic feet, or 29,440 board feet (Scribner rule), of timber per acre from a fully stocked stand of even-aged Douglas-fir trees 80 years old. The Neuns soil can produce about 8,607 cubic feet, or 26,050 board feet (Scribner rule), of timber per acre from a fully stocked stand of even-aged Douglas-fir trees 80 years old.

The main concerns in producing and harvesting timber are equipment limitations, the hazard of erosion, and plant competition. Conventional methods of harvesting trees can be used in the more gently sloping areas, but they are difficult to use in the steeper areas. Spoil from excavations is subject to rill and gully erosion and to

sloughing. Proper design of road drainage systems and care in the placement of culverts help to control erosion.

Reforestation must be carefully managed to reduce competition from undesirable understory plants. Proper site preparation controls initial plant competition, and spraying controls subsequent growth. If site preparation is not adequate, competition from undesirable plants can prevent or prolong natural or artificial reestablishment of trees. Among the trees that are suitable for planting are ponderosa pine and Douglas-fir.

When the density of the forest canopy is less than about 40 percent, this unit produces grazable understory. The understory includes oak, deerbrush, manzanita, squawcarpet, and fescue. Livestock grazing should be managed to protect the soils in the unit from excessive erosion.

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

165—Kindig-Neuns gravelly loams, 50 to 80 percent slopes. This map unit is on mountains. The native vegetation is mainly mixed conifers, shrubs, perennial grasses, and forbs. Elevation is 2,500 to 6,000 feet. The average annual precipitation is about 35 inches, the average annual air temperature is about 48 degrees F, and the average frost-free period is 100 to 125 days.

This unit is 60 percent Kindig gravelly loam and 30 percent Neuns gravelly loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Etsel very gravelly loam, a Marpa soil that has a loam surface layer, a soil that is similar to the Kindig soil but is more than 60 inches deep to bedrock, and Rock outcrop. Included areas make up about 10 percent of the total acreage.

The Kindig soil is deep and well drained. It formed in residuum derived dominantly from metamorphosed rock. Typically, the surface is covered with a mat of undecomposed and partially decomposed needles, leaves, twigs, bark, and other organic debris about 2 inches thick. The surface layer is brown gravelly loam about 5 inches thick. The upper part of the subsoil is pale brown gravelly loam about 10 inches thick. The lower part is light yellowish brown very gravelly loam about 45 inches thick. Weathered rock is at a depth of 60 inches.

Permeability of the Kindig soil is moderate. Available water capacity is low to moderate. Effective rooting depth is 40 to 60 inches. Runoff is very rapid, and the hazard of water erosion is very high.

The Neuns soil is moderately deep and well drained. It formed in residuum derived dominantly from metamorphosed rock. Typically, the surface is covered with a mat of undecomposed and partially decomposed needles, leaves, twigs, bark, and other organic debris

about 2 inches thick. The surface layer is dark brown and light yellowish brown gravelly loam about 8 inches thick. The subsoil is yellowish brown and pale brown very gravelly loam about 27 inches thick. Fractured bedrock is at a depth of 35 inches.

Permeability of the Neuns soil is moderate. Available water capacity is very low to low. Effective rooting depth is 20 to 40 inches. Runoff is very rapid, and the hazard of water erosion is very high.

This unit is used as woodland and for livestock grazing.

This unit is suited to the production of ponderosa pine, Douglas-fir, and sugar pine. The Kindig soil can produce about 9,124 cubic feet, or 29,440 board feet (Scribner rule), of timber per acre from a fully stocked stand of even-aged Douglas-fir trees 80 years old. The Neuns soil can produce about 8,607 cubic feet, or 26,050 board feet (Scribner rule), of timber per acre from a fully stocked stand of even-aged Douglas-fir trees 80 years old.

The main concerns in producing and harvesting timber are the hazard of erosion, equipment limitations, slope, and plant competition. Spoil from excavations is subject to rill and gully erosion and to sloughing. Proper design of road drainage systems and care in the placement of culverts help to control erosion.

The steepness of slope limits the kinds of equipment that can be used in forest management. The high-lead logging method is more efficient than most other methods and is less damaging to the soil surface.

Reforestation must be carefully managed to reduce competition from undesirable understory plants. If site preparation is not adequate, competition from undesirable plants can prevent or prolong natural or artificial reestablishment of trees. Among the trees that are suitable for planting are ponderosa pine and Douglas-fir.

When the density of the forest canopy is less than about 40 percent, this unit produces grazable understory. The understory includes oak, deerbrush, squawcarpet, manzanita, and fescue. Livestock grazing should be managed to protect the soils in the unit from excessive erosion.

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

166—Kinkel very gravelly loam, 2 to 15 percent slopes. This very deep, well drained soil is on mountains. It formed in residuum derived dominantly from metamorphosed rock. The native vegetation is mainly mixed conifers, shrubs, perennial grasses, and forbs. Elevation is 2,500 to 5,000 feet. The average annual precipitation is about 35 inches, the average annual air temperature is about 48 degrees F, and the average frost-free period is about 125 days.

Typically, the surface is covered with a mat of undecomposed and partially decomposed needles,

leaves, twigs, bark, and other organic debris about 1 inch thick. The surface layer is grayish brown and brown very gravelly loam about 9 inches thick. The subsoil is light yellowish brown, light brown, brown, strong brown, and reddish yellow very gravelly loam about 51 inches thick.

Included in this unit are small areas of Boomer and Marpa soils that have a very gravelly loam surface layer and slopes of as little as 2 percent. Also included are small areas of a soil that is similar to this Kinkel soil but has bedrock at a depth of 40 to 60 inches. Included areas make up about 15 percent of the total acreage.

Permeability of this Kinkel soil is moderate. Available water capacity is low to moderate. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland and for livestock grazing.

This unit is suited to the production of ponderosa pine, Douglas-fir, and white fir. It can produce about 2,998 cubic feet, or 13,460 board feet (Scribner rule), of timber per acre from a fully stocked stand of even-aged ponderosa pine trees 80 years old.

The soil in this unit has few limitations for use and management. Among the trees that are suitable for planting are ponderosa pine and Douglas-fir.

When the density of the forest canopy is less than about 40 percent, this unit produces grazable understory. The understory includes deerbrush, needlegrass, buckbrush, and common snowberry.

This map unit is in capability unit IVs-4(5), nonirrigated.

167—Kuck clay loam, 2 to 9 percent slopes. This moderately deep, well drained soil is on hills. It formed in residuum derived dominantly from extrusive igneous rock. The vegetation in areas not cultivated is mainly perennial grasses, forbs, shrubs, and scattered oak and juniper. Elevation is 2,500 to 4,500 feet. The average annual precipitation is about 18 inches, the average annual air temperature is about 50 degrees F, and the average frost-free period is about 125 days.

Typically, the surface layer is dark brown clay loam about 6 inches thick. The upper 14 inches of the subsoil is dark gray clay loam and clay. The lower 12 inches is dark grayish brown gravelly clay loam. Weathered rock is at a depth of 32 inches.

Included in this unit are small areas of Jenny clay on terraces and Lassen clay on hills. Included areas make up about 15 percent of the total acreage.

Permeability of this Kuck soil is slow. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for cultivated crops, hay and pasture, rangeland, and homesite development.

This unit is suited to irrigated and nonirrigated wheat and barley. It is limited mainly by the hazard of erosion,

low to moderate available water capacity, slow permeability, and slope.

In summer, irrigation is required for maximum production of most crops. Because of slope, moderate soil depth, and slow permeability, sprinkler and contour ditch irrigation systems are best suited to this unit. The method used generally is governed by the crop grown. If sprinkler irrigation is used, water needs to be applied slowly to minimize runoff. Irrigation water should be applied at a rate that insures optimum production without increasing runoff, deep percolation, and erosion.

This unit is suited to hay and pasture. Proper grazing practices, weed control, and fertilizer are needed for maximum quality of forage. Seedbed preparation should be on the contour or across the slope where practical. Grazing when the soil in this unit is wet results in compaction of the surface layer, poor tilth, and excessive runoff.

This unit is suited to use as rangeland. The production of vegetation suitable for livestock grazing is limited by the clayey texture of the surface layer and low to moderate available water capacity. The soil in this unit responds well to fertilizer, to range seeding, and to proper grazing use. Grazing should be delayed until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.

The potential plant community on this unit includes bluebunch wheatgrass, Idaho fescue, sheep fescue, and western juniper.

This unit is poorly suited to homesite development. The main limitations are depth to rock, low load supporting capacity, slow permeability, and shrink-swell potential. The deep cuts needed to provide essentially level building sites can expose bedrock.

Preserving the existing plant cover during construction helps to control erosion. Mulching, fertilizing, and irrigating are needed to establish lawn grasses and other small seeded plants.

Where septic tank absorption fields are used, the limitations of slow permeability and moderate depth to rock can be overcome by increasing the size of the absorption field.

If buildings are constructed on the soil in this unit, properly designing foundations and footings and diverting runoff away from buildings help to prevent structural damage as a result of shrinking and swelling. Buildings and roads should be designed to offset the limited ability of the soil to support a load.

This map unit is in capability unit IIIe-1(21), irrigated and nonirrigated.

168—Kuck clay loam, 9 to 15 percent slopes. This moderately deep, well drained soil is on hills. It formed in residuum derived dominantly from extrusive igneous rock. The vegetation in areas not cultivated is mainly perennial grasses, shrubs, forbs, and scattered oak and juniper. Elevation is 2,500 to 4,500 feet. The average

annual precipitation is about 18 inches, the average annual air temperature is about 50 degrees F, and the average frost-free period is about 125 days.

Typically, the surface layer is dark brown clay loam about 6 inches thick. The upper 14 inches of the subsoil is dark gray clay loam and clay. The lower 12 inches is dark grayish brown gravelly clay loam. Weathered rock is at a depth of 32 inches.

Included in this unit are small areas of Jenny clay on terraces and Lassen clay on hills. Included areas make up about 15 percent of the total acreage.

Permeability of this Kuck soil is slow. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for cultivated crops, hay and pasture, rangeland, and homesite development.

This unit is suited to irrigated and nonirrigated wheat and barley. It is limited mainly by the hazard of erosion, low to moderate available water capacity, slow permeability, and slope. In summer, irrigation is required for maximum production of most crops. Contour ditch and sprinkler irrigation systems are suited to this unit. The method used generally is governed by the crop grown. If sprinkler irrigation is used, water needs to be applied slowly to minimize runoff.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth.

If this unit is suited to hay and pasture, the main limitation is slope. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Proper grazing practices, weed control, and fertilizer are needed for maximum quality of forage. Seedbed preparation should be on the contour or across the slope where practical.

This unit is suited to use as rangeland. It has few limitations. The soil in this unit responds well to fertilizer, to range seeding, and to proper grazing use. Grazing should be delayed until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.

The potential plant community on this unit includes bluebunch wheatgrass, Idaho fescue, sheep fescue, and western juniper.

This unit is poorly suited to homesite development. The main limitations are limited depth to rock, low load supporting capacity, slow permeability, shrink-swell potential, and slope. The deep cuts needed to provide essentially level building sites can expose bedrock.

Preserving the existing plant cover during construction helps to control erosion. Mulching, fertilizing, and irrigating are needed to establish lawn grasses and other small seeded plants.

Where septic tank absorption fields are used, the limitations of slow permeability and moderate depth to rock can be overcome by increasing the size of the absorption field.

If buildings are constructed on the soil in this unit, properly designing foundations and footings and diverting runoff away from buildings help to prevent structural damage as a result of shrinking and swelling. Buildings and roads should be designed to offset the limited ability of the soil to support a load.

This map unit is in capability unit IIIe-1(21), irrigated and nonirrigated.

169—Lassen clay, 2 to 9 percent slopes. This moderately deep, well drained soil is on hills (fig. 1). It formed in residuum derived dominantly from extrusive igneous rock. The vegetation in areas not cultivated is mainly perennial grasses, shrubs, forbs, and scattered oak and juniper. Elevation is 2,000 to 4,500 feet. The average annual precipitation is about 18 inches, the average annual air temperature is about 50 degrees F, and the average frost-free period is about 125 days.

Typically, the surface layer is dark grayish brown clay about 26 inches thick. The underlying material is dark grayish brown gravelly clay about 2 inches thick. Bedrock is at a depth of 28 inches.

Included in this unit are small areas of Jenny clay on terraces and Kuck clay on hills. Included areas make up about 15 percent of the total acreage.

Permeability of this Lassen soil is slow. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for cultivated crops, hay and pasture, rangeland, and homesite development.

This unit is suited to irrigated and nonirrigated wheat and barley. It is limited mainly by the hazard of erosion, fine soil texture, depth to rock, slow permeability, and slope. Tillage should be performed when the moisture content is about 50 percent of field capacity.

Because of slope, soil depth, and slow permeability, sprinkler and contour ditch irrigation systems are best suited to the soil in this unit. Irrigation water should be applied at a rate that insures optimum production without increasing runoff, deep percolation, and erosion.

Erosion can be reduced if fall grain is seeded early, stubble-mulch tillage is used, and tillage and seeding are on the contour or across the slope. Also, waterways should be shaped and seeded to perennial grass.



Figure 1—Area of Lassen clay, 2 to 9 percent slopes, in foreground; Lassen cobbly clay, 2 to 15 percent slopes, on the foot slopes in background, and Mary-Rock outcrop complex, 2 to 50 percent slopes, on ridgetops.

Returning crop residue to the soil or regularly adding other organic matter improves fertility, reduces crusting, and increases the water intake rate. Tillage should be kept to a minimum.

This unit is suited to hay and pasture. Proper grazing practices, weed control, and fertilizer are needed for maximum quality of forage. Use of nitrogen and phosphorus fertilizer promotes good growth of forage plants.

This unit is suited to use as rangeland. The main limitation is shrink-swell potential. The soil in this unit responds well to fertilizer, to range seeding, and to proper grazing use. Plants that tolerate shrinking and swelling should be seeded. Grazing should be delayed until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.

The potential plant community on this unit includes bluebunch wheatgrass, beardless wheatgrass, Idaho fescue, and sheep fescue.

This unit is suited to homesite development. The main limitations are soil depth, slow permeability, shrink-swell potential, and low load supporting capacity.

If buildings are constructed on the soil in this unit, properly designing foundations and footings and diverting runoff away from buildings help to prevent structural damage as a result of shrinking and swelling. Buildings and roads should be designed to offset the limited ability of the soil to support a load. Only the part of the site that is used for construction should be disturbed. The deep cuts needed to provide essentially level building sites can expose bedrock.

Where septic tank absorption fields are used, the limitations of slow permeability and moderate soil depth can be overcome by increasing the size of the absorption field.

This map unit is in capability unit IIIe-5(21), irrigated and nonirrigated.

170—Lassen clay, 9 to 15 percent slopes. This moderately deep, well drained soil is on hills. It formed in residuum derived dominantly from extrusive igneous rock. The vegetation in areas not cultivated is mainly perennial grasses, shrubs, forbs, and scattered oak and juniper. Elevation is 2,000 to 4,500 feet. The average annual precipitation is about 18 inches, the average annual air temperature is about 50 degrees F, and the average frost-free period is about 125 days.

Typically, the surface layer is dark grayish brown clay about 26 inches thick. The underlying material is dark grayish brown gravelly clay about 2 inches thick. Bedrock is at a depth of 28 inches.

Included in this unit are small areas of Montague clay that has slopes of 2 to 9 percent, Jenny clay on terraces, Kuck clay loam on hills, Rock outcrop, and areas of a soil that is similar to this Lassen soil but has slopes of more than 15 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Lassen soil is slow. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for cultivated crops, hay and pasture, rangeland, and homesite development.

This unit is suited to irrigated and nonirrigated wheat and barley. It is limited mainly by the hazard of erosion, fine soil texture, depth to rock, slow permeability, and slope. Tillage should be performed when the moisture content is about 50 percent of field capacity.

Because of slope, soil depth, and slow permeability, sprinkler and contour ditch irrigation systems are best suited to the soil in this unit. Irrigation water should be applied at a rate that insures optimum production without increasing runoff, deep percolation, and erosion.

Erosion can be reduced if fall grain is seeded early, stubble-mulch tillage is used, and tillage and seeding are on the contour or across the slope. Also, waterways should be shaped and seeded to perennial grass.

Returning crop residue to the soil or regularly adding other organic matter improves fertility, reduces crusting, and increases the water intake rate. Tillage should be kept to a minimum.

This unit is suited to hay and pasture. Proper grazing practices, weed control, and fertilizer are needed for maximum quality of forage. Use of nitrogen and phosphorus fertilizer promotes good growth of forage plants.

This unit is suited to use as rangeland. The production of vegetation suitable for livestock grazing is limited by shrink-swell potential and susceptibility of the soil to compaction. The soil in this unit responds well to fertilizer, to range seeding, and to proper grazing use.

Plants that tolerate shrinking and swelling should be seeded. Grazing should be delayed until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.

The potential plant community on this unit includes bluebunch wheatgrass, beardless wheatgrass, Idaho fescue, and sheep fescue.

This unit is suited to homesite development. The main limitations are moderate soil depth, slow permeability, shrink-swell potential, and low load supporting capacity.

If buildings are constructed on the soil in this unit, properly designing foundations and footings and diverting runoff away from buildings help to prevent structural damage as a result of shrinking and swelling. Buildings and roads should be designed to offset the limited ability of the soil to support a load. Structures to divert runoff are needed if roads are constructed. Only the part of the site that is used for construction should be disturbed. The deep cuts needed to provide essentially level building sites can expose bedrock.

If septic tank absorption fields are used, the limitations of slow permeability and moderate depth to rock can be overcome by increasing the size of the absorption field.

This map unit is in capability unit IIIe-5(21), irrigated and nonirrigated.

171—Lassen cobbly clay, 2 to 15 percent slopes.

This moderately deep, well drained soil is on hills. It formed in residuum derived dominantly from extrusive igneous rock. The vegetation in areas not cultivated is mainly perennial grasses, shrubs, forbs, and scattered oak and juniper. Elevation is 2,500 to 4,500 feet. The average annual precipitation is about 18 inches, the average annual air temperature is about 50 degrees F, and the average frost-free period is about 125 days.

Typically, the surface layer is dark grayish brown cobbly clay about 26 inches thick. The underlying material is dark grayish brown cobbly clay about 2 inches thick. Bedrock is at a depth of 28 inches.

Included in this unit are small areas of Montague clay, Jenny clay, Kuck clay loam, Rock outcrop, and a soil that is similar to this Lassen soil but has slopes of more than 15 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Lassen soil is slow. Available water capacity is very low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for cultivated crops, hay and pasture, rangeland, and homesite development.

This unit is suited to irrigated and nonirrigated wheat and barley. It is limited mainly by the hazard of erosion, fine soil texture, depth to rock, slow permeability, cobbles, and slope. Tillage should be performed when the moisture content is about 50 percent of field capacity.

Because of slope, soil depth, and slow permeability, sprinkler and contour ditch irrigation systems are best suited to the soil in this unit. Irrigation water should be applied at a rate that insures optimum production without increasing runoff, deep percolation, and erosion.

Erosion can be reduced if fall grain is seeded early, stubble-mulch tillage is used, and tillage and seeding are on the contour or across the slope. Also, waterways should be shaped and seeded to perennial grass. Returning crop residue to the soil or regularly adding other organic matter improves fertility, reduces crusting, and increases the water intake rate. Tillage should be kept to a minimum. The use of equipment is limited by the cobbles on the surface.

This unit is suited to hay and pasture. Proper grazing practices, weed control, and fertilizer are needed for maximum quality of forage. Use of nitrogen and phosphorus fertilizer promotes good growth of forage plants.

This unit is suited to use as rangeland. The production of vegetation suitable for livestock grazing is limited by shrink-swell potential and susceptibility of the soil to compaction.

The soil in this unit responds well to fertilizer, to range seeding, and to proper grazing use. Grazing should be delayed until the soil has drained sufficiently and is firm enough to withstand trampling by livestock. Plants that tolerate shrinking and swelling should be seeded.

The potential plant community on this unit includes sulphurflower, beardless wheatgrass, Idaho fescue, and bluebunch wheatgrass.

This unit is suited to homesite development. The main limitations are moderate soil depth, slow permeability, shrink-swell potential, and low load supporting capacity. The deep cuts needed to provide essentially level building sites can expose bedrock.

Removal of pebbles and cobbles in disturbed areas is required for best results when landscaping, particularly in areas used for lawns. Mulching, fertilizing, and irrigating are needed to establish lawn grasses and other small seeded plants.

If buildings are constructed on the soil in this unit, properly designing foundations and footings and diverting runoff away from buildings help to prevent structural damage as a result of shrinking and swelling. Structures to divert runoff are also needed if roads are constructed. Buildings and roads should be designed to offset the limited ability of the soil to support a load.

If septic tank absorption fields are used, the limitations of slow permeability and moderate soil depth can be overcome by increasing the size of the absorption field.

Erosion is a hazard in the steeper areas. Only the part of the site that is used for construction should be disturbed. Preserving the existing plant cover during construction helps to control erosion.

This map unit is in capability unit IVe-5(21), irrigated and nonirrigated.

172—Lassen-Kuck complex, 15 to 50 percent slopes. This map unit is on hills. The vegetation in areas not cultivated is mainly perennial grasses, forbs, shrubs, and scattered oak and juniper. Elevation is 2,500 to 4,500 feet. The average annual precipitation is about 18 inches, the average annual air temperature is about 50 degrees F, and the average frost-free period is about 125 days.

This unit is 45 percent Lassen clay and 20 percent Kuck clay loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are about 15 percent Rock outcrop and 20 percent small areas of Montague clay that has slopes of 2 to 9 percent and a soil that is similar to the Lassen soil but is very gravelly throughout. Included areas make up about 35 percent of the total acreage.

The Lassen soil is moderately deep and well drained. It formed in residuum derived dominantly from extrusive igneous rock. Typically, the surface layer is dark grayish brown clay about 26 inches thick. The underlying

material is dark grayish brown gravelly clay about 2 inches thick. Bedrock is at a depth of 28 inches.

Permeability of the Lassen soil is slow. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

The Kuck soil is moderately deep and well drained. It formed in residuum derived dominantly from extrusive igneous rock. Typically, the surface layer is dark brown clay loam about 6 inches thick. The upper 14 inches of the subsoil is dark gray clay loam and clay. The lower 12 inches is dark grayish brown gravelly clay loam.

Weathered rock is at a depth of 32 inches.

Permeability of this Kuck soil is slow. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used as rangeland and for homesite development.

This unit is suited to use as rangeland. The production of vegetation suitable for livestock grazing is limited by slope and shrink-swell potential. The soils in this unit respond well to fertilizer, to range seeding, and to proper grazing use. Grazing should be delayed until the soils have drained sufficiently and are firm enough to withstand trampling by livestock. Plants that tolerate shrinking and swelling should be seeded. Brush management improves deteriorated areas of range that are producing more woody shrubs than were present in the potential plant community. Livestock grazing should be managed to protect the unit from excessive erosion.

Steepness of slope limits access by livestock and promotes overgrazing of the less sloping areas. Trails or walkways can be constructed in places to encourage livestock grazing in areas where access is limited.

The potential plant community on this unit includes bluebunch wheatgrass, Idaho fescue, sheep fescue, and western juniper.

This unit is poorly suited to homesite development. The main limitations are moderate soil depth, slow permeability, shrink-swell potential, and low load supporting capacity. Erosion is a hazard in the steeper areas. Only the part of the site that is used for construction should be disturbed. The deep cuts needed to provide essentially level building sites can expose bedrock. Mulching, fertilizing, and irrigating are needed to establish lawn grasses and other small seeded plants.

If buildings are constructed on the soils in this unit, properly designing foundations and footings and diverting runoff away from buildings help to prevent structural damage as a result of shrinking and swelling. Structures to divert runoff are also needed if roads are constructed. Buildings and roads should be designed to offset the limited ability of the soils to support a load.

If septic tank absorption fields are used, the limitations of slow permeability and moderate depth to rock can be overcome by increasing the size of the absorption field.

This map unit is in capability subclass VIe(21), nonirrigated.

173—Lassen-Kuck complex, stony, 2 to 50 percent slopes. This map unit is on hills. The native vegetation is mainly perennial grasses, forbs, shrubs, and scattered oak and juniper. Elevation is 2,500 to 4,500 feet. The average annual precipitation is about 18 inches, the average annual air temperature is about 50 degrees F, and the average frost-free period is about 125 days.

This unit is 35 percent Lassen stony clay and 25 percent Kuck stony clay loam.

Included in this unit are about 20 percent soils that are similar to the Lassen soil but are very gravelly clay throughout, 10 percent Rock outcrop, and 10 percent Montague clay and Jenny clay. Included areas make up about 40 percent of the total acreage.

The Lassen soil is moderately deep and well drained. It formed in residuum derived dominantly from extrusive igneous rock. Typically, the surface layer is dark grayish brown stony clay about 9 inches thick. The underlying material is dark grayish brown cobbly clay about 19 inches thick. Bedrock is at a depth of 28 inches. A few stones are on the surface in most places.

Permeability of the Lassen soil is slow. Available water capacity is very low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is medium to rapid, and the hazard of water erosion is moderate to high.

The Kuck soil is moderately deep and well drained. It formed in residuum derived dominantly from extrusive igneous rock. Typically, the surface layer is dark brown stony clay loam about 6 inches thick. The upper 14 inches of the subsoil is dark gray stony clay loam and stony clay. The lower 12 inches is dark grayish brown stony clay loam. Weathered rock is at a depth of 32 inches. A few stones are on the surface in most places.

Permeability of the Kuck soil is slow. Available water capacity is low or moderate. Effective rooting depth is 20 to 40 inches. Runoff is medium to rapid, and the hazard of water erosion is moderate to high.

This unit is used as rangeland and for homesite development.

This unit is suited to rangeland. The production of vegetation suitable for livestock grazing is limited by slope, the hazard of erosion, and shrink-swell potential. Grazing should be delayed until the soils in this unit have drained sufficiently and are firm enough to withstand trampling by livestock. Brush management improves deteriorated areas of range that are producing more woody shrubs than were present in the potential plant community. Plants that tolerate shrinking and swelling should be seeded. Livestock grazing should be managed to protect the unit from excessive erosion.

Steepness of slope limits access by livestock and promotes overgrazing of the less sloping areas. Trails and walkways can be constructed in places to

encourage livestock grazing in areas where access is limited.

The potential plant community on this unit includes bluebunch wheatgrass, beardless wheatgrass, Idaho fescue, and western juniper.

This unit is poorly suited to homesite development. The main limitations are moderate soil depth, stoniness, low load supporting capacity, slow permeability, shrink-swell potential, and slope. The deep cuts needed to provide essentially level building sites can expose bedrock.

Erosion is a hazard in the steeper areas. Only the part of the site that is used for construction should be disturbed. Preserving the existing plant cover during construction helps to control erosion.

Mulching, fertilizing, and irrigating are needed to establish lawn grasses and other small seeded plants. Removal of pebbles, cobbles, and stones in disturbed areas is required for best results when landscaping, particularly in areas used for lawns.

If buildings are constructed on the soils in this unit, properly designing foundations and footings and diverting runoff away from buildings help to prevent structural damage as a result of shrinking and swelling. Structures to divert runoff are also needed if roads are constructed. Buildings and roads should be designed to offset the limited ability of the soils to support a load.

If septic tank absorption fields are used, the limitations of slow permeability and moderate depth to rock can be overcome by increasing the size of the absorption field.

This map unit is in capability subclass VIe(21), nonirrigated.

174—Lassen-Rock outcrop-Kuck complex, 2 to 50 percent slopes. This unit is on hills. The native vegetation is mainly perennial grasses, forbs, shrubs, and scattered oak and juniper. Elevation is 2,500 to 4,500 feet. The average annual precipitation is about 18 inches, the average annual air temperature is about 50 degrees F, and the average frost-free period is about 125 days.

This unit is 25 percent Lassen very stony clay, 20 percent Rock outcrop, and 15 percent Kuck very stony clay loam.

Included in this unit are about 15 percent soils that are similar to this Lassen soil but are very gravelly clay throughout, 15 percent Montague clay, and 10 percent Jenny clay. Included areas make up about 40 percent of the total acreage.

The Lassen soil is moderately deep and well drained. It formed in residuum derived dominantly from extrusive igneous rock. Typically, the surface layer is dark grayish brown very stony clay about 9 inches thick. The underlying material is dark grayish brown cobbly clay about 19 inches thick. Bedrock is at a depth of 28 inches. Many stones are on the surface in most places.

Permeability of the Lassen soil is slow. Available water capacity is very low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is medium to rapid, and the hazard of water erosion is moderate to high.

Rock outcrop consists of exposures of bedrock. Rock outcrop is barren of vegetation except for that in fractures in the rock.

The Kuck soil is moderately deep and well drained. It formed in residuum derived dominantly from extrusive igneous rock. Typically, the surface layer is dark brown very stony clay loam about 6 inches thick. The upper 14 inches of the subsoil is dark gray stony clay loam and stony clay. The lower 12 inches is dark grayish brown stony clay loam. Weathered rock is at a depth of 32 inches. Many stones are on the surface in most places.

Permeability of the Kuck soil is slow. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is medium to rapid, and the hazard of water erosion is moderate to high.

This unit is used as rangeland.

This unit is poorly suited to use as rangeland. The production of vegetation suitable for livestock grazing is limited by stoniness, the areas of Rock outcrop, the hazard of erosion, shrink-swell potential, and slope. Use of mechanical treatment practices is not practical because of the stones on the surface and the areas of Rock outcrop.

Grazing should be delayed until the soils in this unit have drained sufficiently and are firm enough to withstand trampling by livestock. Plants that tolerate shrinking and swelling should be seeded. Brush management improves deteriorated areas of range that are producing more woody shrubs than were present in the potential plant community.

Livestock grazing should be managed to protect the unit from excessive erosion. Steepness of slope limits access by livestock and promotes overgrazing of the less sloping areas.

The potential plant community on this unit includes bluebunch wheatgrass, beardless wheatgrass, Idaho fescue, and western juniper.

This map unit is in capability subclass VIIs(21), nonirrigated.

175—Lava flows. This map unit consists of sharp jagged surfaces, crevices, and angular lava blocks. It is in the Cascade Mountain Range. Soil material is in a few cracks and sheltered pockets. Slope is 9 to 50 percent. Drainage is excessive, and runoff is very rapid. Areas are nearly barren of vegetation.

Included in this unit are small areas of shallow and very shallow soils of various textures, Mary loam, Jilson gravelly loam, and areas of Lava flows where slopes are as much as 80 percent. Included areas make up about 15 percent of the mapped acreage.

Lava flows is used by wildlife.

This map unit is in capability subclass VIII(22), nonirrigated.

176—Lava flows-Xerorthents complex, 0 to 50 percent slopes. This map unit is on mountains. The vegetation is mainly brush, shrubs, annual grasses, and forbs. Elevation is dominantly 3,000 to 5,000 feet but ranges to nearly 8,300 feet on Goosenest Mountain. The average annual precipitation is 20 to 40 inches, the average annual air temperature is 48 to 52 degrees F, and the average frost-free season is 60 to 125 days.

This unit is about 40 percent Lava flows and 30 percent Xerorthents.

Included in this unit are small areas of soils that are similar to Xerorthents but are underlain by bedrock at a depth of 40 to 60 inches. Also included are areas of Rubble land and Riverwash. Included areas make up about 30 percent of the mapped acreage.

Lava flows consists of sharp jagged surfaces, crevices, and angular lava blocks.

Xerorthents are very shallow to moderately deep, excessively drained soils that formed in residual material derived from basalt and andesite. These soils have a surface layer that is variable in texture and is underlain by bedrock at a depth of 8 to 40 inches.

This unit is used for wildlife habitat and watershed.

This map unit is in capability subclass VIII(22), nonirrigated.

177—Lithic Haploxerolls-Rock outcrop complex, 0 to 65 percent slopes. This map unit is on mountains. The vegetation is mainly brush, shrubs, annual grasses, and forbs. Elevation ranges from 2,000 to 6,000 feet. The average annual precipitation is 20 to 50 inches, the average annual air temperature is 48 to 52 degrees F, and the average frost-free season is 60 to 125 days.

This unit is about 40 percent Lithic Haploxerolls and 30 percent Rock outcrop.

Included in this unit are soils that are similar to Lithic Haploxerolls but have a clay loam or clay subsoil or are underlain by bedrock at a depth of 10 to 40 inches. Also included are areas of Rubble land and Riverwash. Included areas make up about 30 percent of the mapped acreage.

The Lithic Haploxerolls are very shallow, excessively drained soils that formed in residual material derived from intrusive igneous or metamorphic rock. These soils have a dark colored surface layer that is variable in texture and is underlain by bedrock at a depth of 8 to 10 inches. Reaction is slightly acid or neutral.

Rock outcrop consists of exposures of intrusive igneous or metamorphic rock that is barren of vegetation.

This unit is used for wildlife habitat and watershed.

This map unit is in capability subclass VIII(5,22), nonirrigated.

178—Lithic Xerorthents-Rock outcrop complex, 0 to 65 percent slopes. This map unit is on mountains. The vegetation is mainly brush, shrubs, annual grasses, and forbs. Elevation is 2,000 to 6,000 feet. The average annual precipitation is 20 to 50 inches, the average annual air temperature is 48 to 52 degrees F, and the average frost-free season is 50 to 125 days.

This unit is about 40 percent Lithic Xerorthents and 30 percent Rock outcrop.

Included in this unit are small areas of soils that are similar to Lithic Xerorthents but are 10 to 40 inches deep to bedrock, Rubble land, Riverwash, and areas where slopes are more than 65 percent. These included areas make up about 30 percent of the mapped acreage.

Lithic Xerorthents are very shallow and excessively drained. They formed in residual material derived from intrusive igneous, sedimentary, or metamorphic rock. These soils have a surface layer that varies in texture and is underlain by bedrock at a depth of 8 to 10 inches.

Rock outcrop consists of exposures of intrusive igneous, sedimentary, or metamorphic rock.

This unit is used for wildlife habitat and watershed.

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

179—Louie loam, 0 to 2 percent slopes. This well drained soil is on terraces. It is moderately deep to a hardpan. The soil formed in alluvium derived dominantly from extrusive igneous rock. The vegetation in areas not cultivated is mainly perennial grasses, shrubs, and scattered juniper. Elevation is 2,500 to 3,500 feet. The average annual precipitation is about 13 inches, the average annual air temperature is about 50 degrees F, and the average frost-free period is about 125 days.

Typically, the surface layer is light brownish gray loam about 12 inches thick. The upper 9 inches of the subsoil is yellowish brown loam. The lower 8 inches is yellowish brown sandy clay loam. The next layer is a light yellowish brown, strongly cemented hardpan about 3 inches thick. The underlying material to a depth of 60 inches or more is stratified sand, gravel, cobbles, and some stones. In some areas the surface layer is sandy loam.

Included in this unit are small areas of a soil that is similar to this Louie soil but has a hardpan at a depth of more than 40 inches. Also included are small areas of Redola loam. Included areas make up about 15 percent of the total acreage.

Permeability of this Louie soil is moderately slow above the impervious hardpan but is rapid below. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for cultivated crops, hay and pasture, rangeland, and homesite development.

This unit is suited to irrigated wheat and barley. It is limited mainly by low to moderate available water

capacity and depth to the hardpan. Because precipitation is not sufficient for annual cropping, a cropping system that includes small grain and summer fallow is most suitable.

In summer, irrigation is required for maximum production of most crops. Furrow, border, corrugation, and sprinkler irrigation systems are suited to the soil in this unit. The method used generally is governed by the crop grown. Irrigation water must be applied carefully to prevent the development of a perched water table.

The hardpan can be ripped and shattered. This increases the effective rooting depth and improves internal drainage. Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures increase fertility and tilth.

If this unit is used for hay and pasture, the main limitations are low to moderate available water capacity and limited rooting depth. Proper grazing practices, weed control, and fertilizer are needed for maximum quality of forage. Irrigation water can be applied by the sprinkler and border methods.

This unit is suited to use as rangeland. Production of vegetation suitable for livestock grazing is limited by low to moderate available water capacity and restricted rooting depth. Management practices suitable for use on the soil in this unit are proper range use, deferred grazing, rotation grazing, and aerial spraying for brush management. Drought resistant plants are suitable for seeding.

The potential plant community on this unit includes Idaho fescue, bluebunch wheatgrass, beardless wheatgrass, and buckbrush.

This unit is suited to homesite development. The main limitation is the depth to the hardpan. The deep cuts needed to provide essentially level building sites can expose the hardpan. The hardpan can be ripped and shattered.

Preserving the existing plant cover during construction helps to control erosion. Mulching, fertilizing, and irrigating are needed to establish lawn grasses and other small seeded plants.

If septic tank sewage disposal systems are used, the limitation of moderate depth to the hardpan can be overcome by increasing the size of the absorption field or by placing the tile line below the hardpan.

This map unit is in capability unit IIIs-8(21), irrigated and nonirrigated.

180—Louie loam, 2 to 9 percent slopes. This well drained soil is on terraces. It is moderately deep to a hardpan. The soil formed in alluvium derived dominantly from extrusive igneous rock. The vegetation in areas not cultivated is mainly perennial grasses, shrubs, and scattered juniper. Elevation is 2,500 to 3,500 feet. The average annual precipitation is about 13 inches, the

average annual air temperature is about 50 degrees F, and the average frost-free period is about 125 days.

Typically, the surface layer is light brownish gray loam about 12 inches thick. The upper 9 inches of the subsoil is yellowish brown loam. The lower 8 inches is yellowish brown sandy clay loam. The next layer is a light yellowish brown, strongly cemented hardpan about 3 inches thick. The underlying material to a depth of 60 inches or more is stratified sand, gravel, cobbles, and some stones. In some areas the surface layer is sandy loam.

Included in this unit are small areas of a soil that is similar to this Louie soil but has a hardpan at a depth of more than 40 inches. Also included are small areas of Redola loam. Included areas make up about 15 percent of the total acreage.

Permeability of this Louie soil is moderately slow above the impervious hardpan but is rapid below. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for cultivated crops, hay and pasture, rangeland, and homesite development.

This unit is suited to irrigated wheat and barley. It is limited mainly by low to moderate available water capacity, the depth to the hardpan, and slope. Because precipitation is not sufficient for annual cropping, a cropping system that includes small grain and summer fallow is most suitable.

In summer, irrigation is required for maximum production of most crops. Furrow, border, corrugation, and sprinkler irrigation systems are suited to the soil in this unit. The method used generally is governed by the crop grown. If furrow or corrugation irrigation systems are used, runs should be on the contour or across the slope. Irrigation water must be applied carefully to prevent the development of a perched water table.

The hardpan can be ripped and shattered. This increases the effective rooting depth and improves internal drainage. Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to increase fertility and tilth.

If this unit is used for hay and pasture, the main limitations are low to moderate available water capacity and slope. Proper grazing practices, weed control, and fertilizer are needed for maximum quality of forage. Irrigation water can be applied by the sprinkler method.

This unit is suited to use as rangeland. The production of vegetation suitable for livestock grazing is limited by low to moderate available water capacity and restricted rooting depth. Management practices suitable for use on this unit are proper range use, deferred grazing, rotation grazing, and aerial spraying for brush management. Drought resistant plants are suitable for seeding.

The potential plant community on this unit includes Idaho fescue, bluebunch wheatgrass, beardless wheatgrass, and buckbrush.

This unit is suited to homesite development. The main limitations are the depth to the hardpan and slope. The deep cuts needed to provide essentially level building sites can expose the hardpan; however, it can be ripped and shattered. Preserving the existing plant cover during construction helps to control erosion. Mulching, fertilizing, and irrigating are needed to establish lawn grasses and other small seeded plants.

The suitability of the soil in this unit for septic tank absorption fields can be improved by ripping the hardpan to increase permeability.

This map unit is in capability unit IIIe-8(21), irrigated and nonirrigated.

181—Louie stony loam, 0 to 9 percent slopes. This well drained soil is on terraces. It is moderately deep to a hardpan. The soil formed in alluvium derived dominantly from extrusive igneous rock. The vegetation in areas not cultivated is mainly perennial grasses, forbs, shrubs, and scattered juniper. Elevation is 2,500 to 3,500 feet. The average annual precipitation is about 13 inches, the average annual air temperature is about 50 degrees F, and the average frost-free period is about 125 days.

Typically, the surface layer is light brownish gray stony loam about 12 inches thick. The upper 9 inches of the subsoil is yellowish brown stony loam. The lower 8 inches is yellowish brown stony sandy clay loam. The next layer is a light yellowish brown, strongly cemented hardpan about 3 inches thick. The underlying material to a depth of 60 inches or more is stratified sand, gravel, cobbles, and some stones. A few stones are on the surface in some areas.

Included in this unit are small areas of a soil that is similar to this Louie soil but has a hardpan at a depth of more than 40 inches. Also included are small areas of Redola loam. Included areas make up about 15 percent of the total acreage.

Permeability of this Louie soil is moderately slow above the impervious hardpan but is rapid below. Available water capacity is very low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as rangeland and for homesite development. If the stones on the surface are removed, the unit can be cultivated.

This unit is suited to use as rangeland. The production of vegetation suitable for livestock grazing is limited by very low to moderate available water capacity, restricted rooting depth, and stones on the surface. Management practices suitable for use on this unit are proper range use, deferred grazing, rotation grazing, and aerial spraying for brush management. Use of mechanical treatment practices is not practical, because the surface

is stony. Drought resistant plants are suitable for seeding.

The potential plant community on this unit includes Idaho fescue, bluebunch wheatgrass, bottlebrush squirreltail, junegrass, and buckbrush.

This unit is suited to homesite development. The main limitations are the depth to the hardpan, stones, and slope. Preserving the existing plant cover during construction helps to control erosion. Removal of pebbles and cobbles in disturbed areas is required for best results when landscaping, particularly in areas used for lawns. Mulching, fertilizing, and irrigating are needed to establish lawn grasses and other small seeded plants.

The suitability of the soil in this unit for septic tank absorption fields can be improved by ripping the hardpan to increase the depth of the more permeable material.

This map unit is in capability subclass VIe(21), nonirrigated.

182—Louie Variant sandy clay loam, 2 to 9 percent slopes. This well drained soil is on terraces. It is moderately deep to a hardpan. The soil formed in alluvium derived dominantly from extrusive igneous rock. The vegetation in areas not cultivated is mainly perennial grasses, forbs, shrubs, and scattered juniper. Elevation is 2,500 to 3,500 feet. The average annual precipitation is about 13 inches, the average annual air temperature is about 50 degrees F, and the average frost-free period is about 125 days.

Typically, the surface layer is gray and light brownish gray sandy clay loam about 15 inches thick. The subsoil is light brownish gray sandy clay loam about 11 inches thick. The substratum is light gray loam about 7 inches thick. Below this is a light brownish gray, moderately cemented hardpan about 27 inches thick. In a few places the surface layer is silty clay loam.

Included in this unit are small areas of soils that are similar to this Louie Variant soil but have a hardpan at a depth of less than 20 inches or more than 40 inches. Included areas make up about 20 percent of the total acreage.

Permeability of this Louie Variant soil is moderately slow. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

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

If this unit is used for hay and pasture, the main limitations are the depth to the hardpan and slope. The hardpan can be ripped and shattered. This increases the effective rooting depth and improves internal drainage. Proper grazing practices, weed control, and fertilizer are needed for maximum quality of forage. Irrigation water can be applied by the sprinkler and contour border methods.

This unit is suited to use as rangeland. The production of vegetation suitable for livestock grazing is limited by

the low to moderate available water capacity and the restricted rooting depth. Range seeding is a suitable practice if the range vegetation is in poor condition.

The potential plant community on this unit is mainly bottlebrush squirreltail, redstem filaree, Thurber needlegrass, Idaho fescue, and western juniper.

This unit is suited to homesite development. The main limitations are the depth to the hardpan, slow permeability, and slope. Preserving the existing plant cover during construction helps to control erosion. Mulching, fertilizing, and irrigating are needed to establish lawn grasses and other small seeded plants.

The suitability of the soil in this unit for septic tank absorption fields can be improved by ripping the hardpan to increase the depth of the more permeable material so that it can absorb effluent. The limitation of moderately slow permeability can be overcome by increasing the size of the absorption field.

This map unit is in capability unit IIIe-3(21), irrigated and nonirrigated.

183—Marpa-Kinkel-Boomer, cool complex, 5 to 15 percent slopes. This map unit is on mountains. The native vegetation is mainly mixed conifers, shrubs, perennial grasses, and forbs. Elevation is 2,500 to 5,000 feet. The average annual precipitation is about 35 inches, the average annual air temperature is about 48 degrees F, and the average frost-free period is about 125 days.

This unit is 30 percent Marpa gravelly loam, 25 percent Kinkel very gravelly loam, and 20 percent Boomer gravelly loam, cool. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are about 15 percent Etsel very gravelly loam that has slopes of 30 to 75 percent, Neuns gravelly loam, Kindig gravelly loam that has slopes of 15 to 50 percent, and a soil that is similar to this Kinkel soil but has bedrock at a depth of 20 to 40 inches. Also included is about 10 percent Rock outcrop. Included areas make up about 25 percent of the total acreage.

The Marpa soil is moderately deep and well drained. It formed in residuum derived dominantly from metamorphosed rock. Typically, the surface is covered with a mat of undecomposed and partially decomposed needles, leaves, twigs, bark, and other organic debris about 2 inches thick. The surface layer is grayish brown and brown very gravelly loam about 9 inches thick. The subsoil to a depth of 60 inches or more is light yellowish brown, light brown, brown, strong brown, and reddish yellow very gravelly loam.

Permeability of the Kinkel soil is moderate. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

The Kinkel soil is very deep and well drained. It formed in residuum derived dominantly from

metamorphosed rock. Typically, the surface is covered with a mat of undecomposed and partially decomposed needles, leaves, twigs, bark, and other organic debris about 1 inch thick. The surface layer is grayish brown and brown very gravelly loam about 9 inches thick. The subsoil to a depth of 60 inches or more is light yellowish brown, light brown, brown, strong brown, and reddish yellow very gravelly loam.

Permeability of the Kinkel soil is moderate. Available water capacity is low to moderate. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

The Boomer soil is deep and well drained. It formed in residuum derived dominantly from metamorphosed rock. Typically, the surface is covered with a mat of undecomposed and partially decomposed needles, leaves, twigs, bark, and other organic debris about 1 inch thick. The surface layer is brown gravelly loam about 10 inches thick. The upper 30 inches of the subsoil is yellowish red gravelly clay loam. The lower 13 inches is yellowish red gravelly sandy clay loam. Weathered rock is at a depth of 53 inches.

Permeability of the Boomer soil is moderately slow. Available water capacity is moderate or high. Effective rooting depth is 40 to 60 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland and for livestock grazing.

This unit is suited to the production of ponderosa pine and Douglas-fir. The Marpa soil can produce about 3,693 cubic feet, or 16,610 board feet (Scribner rule), of timber per acre; the Kinkle soil can produce about 2,998 cubic feet, or 13,460 board feet; and the Boomer soil can produce 4,110 cubic feet, or 18,500 board feet.

Production is estimated for a fully stocked stand of even-aged ponderosa pine trees 80 years old.

This soil has few limitations for use as woodland. Roads and landings can be protected from erosion by constructing water bars and by seeding cuts and fills. The low available water capacity generally influences seedling survival in areas where understory plants are numerous. Among the trees that are suitable for planting are ponderosa pine and Douglas-fir.

When the density of the forest canopy is less than about 40 percent this soil produces grazable understory. The understory on the Marpa soil includes needlegrass, western mountainmahogany, tall Oregon-grape, and mountain brome; on the Kinkle soil it includes deerbrush, needlegrass, buckbrush, and common snowberry; and on the Boomer soil it includes bluegrass, mountain brome, blue wildrye, and needlegrass.

This map unit is in capability unit IVe-4(5), nonirrigated.

184—Marpa-Kinkel-Boomer, cool complex, 15 to 50 percent slopes. This map unit is on mountains. The native vegetation is mainly mixed conifers, shrubs, perennial grasses, and forbs. Elevation is 2,500 to 5,000

feet. The average annual precipitation is about 35 inches, the average annual air temperature is about 48 degrees F, and the average frost-free period is about 125 days.

This unit is 30 percent Marpa gravelly loam, 25 percent Kinkel very gravelly loam, and 20 percent Boomer gravelly loam, cool. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are about 15 percent Rock outcrop and 10 percent Etsel very gravelly loam that has slopes of 30 to 75 percent, Kindig gravelly loam, Neuns gravelly loam, and a soil that is similar to this Kinkel soil but has bedrock at a depth of 20 to 40 inches. Included areas make up about 25 percent of the total acreage.

The Marpa soil is moderately deep and well drained. It formed in residuum derived dominantly from metamorphosed rock. Typically, the surface is covered with a mat of undecomposed and partially decomposed needles, leaves, twigs, bark, and other organic debris about 2 inches thick. The surface layer is pale brown gravelly loam about 14 inches thick. The subsoil is light yellowish brown very gravelly sandy clay loam about 16 inches thick. Bedrock is at a depth of 30 inches.

Permeability of the Marpa soil is moderate. Available water capacity is very low or low. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

The Kinkel soil is very deep and well drained. It formed in residuum derived dominantly from metamorphosed rock. Typically, the surface is covered with a mat of undecomposed and partially decomposed needles, leaves, twigs, bark, and other organic debris about 1 inch thick. The surface layer is grayish brown and brown very gravelly loam about 9 inches thick. The subsoil to a depth of 60 inches or more is light yellowish brown, light brown, brown, strong brown, and reddish yellow very gravelly loam.

Permeability of the Kinkel soil is moderate. Available water capacity is low to moderate. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

The Boomer soil is deep and well drained. It formed in residuum derived dominantly from metamorphosed rock. Typically, the surface is covered with a mat of undecomposed and partially decomposed needles, leaves, twigs, bark, and other organic debris about 1 inch thick. The surface layer is brown gravelly loam about 10 inches thick. The upper 30 inches of the subsoil is yellowish red gravelly clay loam. The lower 13 inches is yellowish red gravelly sandy clay loam. Weathered rock is at a depth of 53 inches.

Permeability of the Boomer soil is moderately slow. Available water capacity is moderate or high. Effective rooting depth is 40 to 60 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used as woodland and for livestock grazing.

This unit is suited to the production of ponderosa pine and Douglas-fir. The Marpa soil can produce about 3,693 cubic feet, or 16,610 board feet (Scribner rule), of timber per acre; the Kinkel soil can produce about 2,998 cubic feet, or 13,460 board feet; and the Boomer soil can produce about 4,110 cubic feet, or 18,500 board feet. Production is estimated for a fully stocked stand of even-aged ponderosa pine trees 80 years old.

The main concerns in producing and harvesting timber are the hazard of erosion, low available water capacity, and plant competition. Management that minimizes the risk of erosion is essential in harvesting timber. Proper design of road drainage systems and care in the placement of culverts help to control erosion. Roads and landings can be protected from erosion by constructing water bars and by seeding cuts and fills. The low available water capacity generally influences seedling survival on the Marpa and Kinkel soils in areas where understory plants are numerous. Among the trees that are suitable for planting are ponderosa pine and Douglas-fir.

When the density of the forest canopy is less than about 40 percent, this unit produces grazable understory. The understory on the Marpa soil includes needlegrass, western mountainmahogany, tall Oregon-grape, and mountain brome. On the Kinkel soil it includes deerbrush, needlegrass, buckbrush, and common snowberry. On the Boomer soil it includes bluegrass, mountain brome, blue wildrye, and needlegrass.

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

185—Mary loam, 2 to 9 percent slopes. This moderately deep, well drained soil is on hills. It formed in residuum derived dominantly from extrusive igneous rock. The native vegetation is mainly perennial grasses, shrubs, and forbs. Elevation is 2,500 to 4,500 feet. The average annual precipitation is about 18 inches, the average annual air temperature is about 50 degrees F, and the average frost-free period is about 125 days.

Typically, the surface layer is dark brown loam about 10 inches thick. The upper 7 inches of the subsoil is dark brown loam. The lower 11 inches is dark yellowish brown clay loam and sandy clay loam. Bedrock is at a depth of 28 inches.

Included in this unit are small areas of Hilt sandy loam, Kuck clay loam, Terwilliger silty clay loam, and Rock outcrop. Included areas make up about 15 percent of the total acreage.

Permeability of this Mary soil is moderately slow. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for cultivated crops and as rangeland.

This unit is suited to irrigated and nonirrigated wheat and barley. It is limited mainly by depth to rock and slope. Because of slope and the limited soil depth, sprinkler and contour ditch irrigation systems are best suited to the soil in this unit. Waterways should be shaped and seeded to perennial grass. Limiting tillage for seedbed preparation and weed control reduces runoff and erosion. Tillage and fertility can be improved by returning crop residue to the soil.

This unit is suited to use as rangeland. It has few limitations. The soil in the unit responds well to fertilizer, to range seeding, and to proper grazing use.

The potential plant community on this unit includes Idaho fescue, bluebunch wheatgrass, beardless wheatgrass, Sandberg bluegrass, and buckbrush.

This map unit is in capability unit IIIe-8(21), irrigated and nonirrigated.

186—Mary loam, 9 to 15 percent slopes. This moderately deep, well drained soil is on hills. It formed in residuum derived dominantly from extrusive igneous rock. The native vegetation is mainly perennial grasses, shrubs, and forbs. Elevation is 2,500 to 4,500 feet. The average annual precipitation is about 18 inches, the average annual air temperature is about 50 degrees F, and the average frost-free period is about 125 days.

Typically, the surface layer is dark brown loam about 10 inches thick. The upper 7 inches of the subsoil is dark brown loam. The lower 11 inches is dark yellowish brown clay loam and sandy clay loam. Bedrock is at a depth of 28 inches.

Included in this unit are small areas of Hilt sandy loam, Kuck clay loam, Terwilliger silty clay loam, Rock outcrop, and soils that are similar to this Mary soil but have slopes of as much as 30 percent. Included areas make up about 20 percent of the total acreage.

Permeability of this Mary soil is moderately slow. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for cultivated crops and as rangeland.

This unit is suited to irrigated and nonirrigated wheat and barley. It is limited mainly by the hazard of erosion, depth to rock, and slope. Erosion can be reduced if fall grain is seeded early, stubble-mulch tillage is used, and tillage and seeding are on the contour or across the slope. Also, waterways should be shaped and seeded to perennial grass. Limiting tillage for seedbed preparation and weed control reduces runoff and erosion. Returning crop residue to the soil improves tillage and fertility.

This unit is suited to use as rangeland. It has few limitations. The soil in the unit responds well to fertilizer, to range seeding, and to proper grazing use.

The potential plant community on this unit is mainly Idaho fescue, bluebunch wheatgrass, beardless wheatgrass, Sandberg bluegrass, and buckbrush.

This map unit is in capability unit IIIe-8(21), irrigated and nonirrigated.

187—Mary stony loam, 2 to 50 percent slopes. This moderately deep, well drained soil is on hills. It formed in residuum derived dominantly from extrusive igneous rock. The native vegetation is mainly perennial grasses, shrubs, and forbs. Elevation is 2,500 to 4,500 feet. The average annual precipitation is about 18 inches, the average annual air temperature is about 50 degrees F, and the average frost-free period is about 125 days.

Typically, the surface layer is dark brown stony loam about 10 inches thick. The upper 7 inches of the subsoil is dark brown loam. The lower 11 inches is dark yellowish brown clay loam and sandy clay loam. Bedrock is at a depth of 28 inches. A few stones are on the surface in most places.

Included in this unit are small areas of Hilt sandy loam, 15 to 30 percent slopes, Terwilliger silty clay loam, and Rock outcrop. Included areas make up about 20 percent of the total acreage.

Permeability of this Mary soil is moderately slow. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is medium to rapid, and the hazard of water erosion is moderate to high.

This unit is used as rangeland.

This unit is suited to use as rangeland. The production of vegetation suitable for livestock grazing is limited by the hazard of erosion, slope, and stones on the surface. Steepness of slope limits access by livestock and promotes overgrazing of the less sloping areas. Use of mechanical treatment practices is not practical, because the surface is stony.

Management practices suitable for use on the soil in this unit are proper range use, deferred grazing, and rotation grazing. Grazing should be delayed until the soil is firm and the more desirable forage plants have achieved sufficient growth to withstand grazing pressure.

The potential plant community on this unit includes Idaho fescue, bluebunch wheatgrass, bottlebrush squirreltail, and buckbrush.

This map unit is in capability subclass VIe(21), nonirrigated.

188—Mary-Rock outcrop complex, 2 to 50 percent slopes. This map unit is on hills. The native vegetation is mainly perennial grasses, shrubs, and forbs. Elevation is 2,500 to 4,500 feet. The average annual precipitation is about 18 inches, the average annual air temperature is about 50 degrees F, and the average frost-free period is about 125 days.

This unit is 40 percent Mary stony loam and 25 percent Rock outcrop. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Hilt sandy loam, Terwilliger silty clay loam, and soils that are similar to the Mary soil but have slopes of more than 50 percent. Included areas make up about 35 percent of the total acreage.

The Mary soil is moderately deep and well drained. It formed in residuum derived dominantly from extrusive igneous rock. Typically, the surface layer is dark brown stony loam about 10 inches thick. The upper 7 inches of the subsoil is dark brown loam. The lower 11 inches is dark yellowish brown clay loam and sandy clay loam. Bedrock is at a depth of 28 inches. A few stones are on the surface in most places.

Permeability of this Mary soil is moderately slow. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

Rock outcrop consists of exposures of bedrock. It supports no vegetation.

This unit is used as rangeland.

This unit is poorly suited to use as rangeland. The production of vegetation suitable for livestock grazing is limited mainly by the hazard of erosion, slope, stoniness, and areas of Rock outcrop. Steepness of slope limits access by livestock and promotes overgrazing of the less sloping areas. Use of mechanical treatment practices is not practical, because the surface is stony.

Management practices suitable for use on this unit are proper range use, deferred grazing, rotation grazing, and brush management. Grazing should be delayed until the soil in the unit is firm and the more desirable forage plants have achieved sufficient growth to withstand grazing pressure.

The potential plant community on this unit includes Idaho fescue, bluebunch wheatgrass, bottlebrush squirreltail, and buckbrush.

This map unit is in capability subclass VII(21), nonirrigated.

189—Medford clay loam, cool, 0 to 2 percent slopes. This very deep, moderately well drained soil is on alluvial fans. It formed in alluvium derived from mixed rock sources. The vegetation in areas not cultivated is mainly perennial grasses, forbs, shrubs, and scattered oak. Elevation is 2,200 to 4,000 feet. The average annual precipitation is about 18 inches, the average annual air temperature is about 50 degrees F, and the average frost-free period is about 125 days.

Typically, the surface layer is very dark grayish brown clay loam about 18 inches thick. The upper 23 inches of the subsoil is dark brown and yellowish brown clay. The lower 8 inches is yellowish brown clay loam. The substratum to a depth of 60 inches or more is yellowish brown clay loam.

Included in this unit are small areas of Dotta loam, Jenny clay, and a soil that is similar to this Medford soil but is moderately alkaline and calcareous throughout.

Included areas make up about 20 percent of the total acreage.

Permeability of this Medford soil is moderately slow. Available water capacity is high to very high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for cultivated crops, hay and pasture, rangeland, and homesite development.

This unit is suited to irrigated and nonirrigated wheat and barley. It has few limitations. Furrow, border, corrugation, and sprinkler irrigation systems are suited to the unit. If sprinkler irrigation is used, water needs to be applied slowly to minimize runoff. Leveling is needed in sloping areas for the efficient application and removal of irrigation water. Water should be applied at a slow rate over a long period to insure that the root zone is properly wetted.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures increase fertility and tilth.

This unit is suited to hay and pasture. It has few limitations. Proper grazing practices, weed control, and fertilizer are needed for maximum quality of forage. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff.

This unit is suited to use as rangeland. It has few limitations. The soil in the unit responds well to fertilizer, to range seeding, and to proper grazing use. Grazing should be delayed until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.

The potential plant community on this unit includes bottlebrush squirreltail, Thurber needlegrass, and western juniper.

This unit is suited to homesite development. The main limitations are load supporting capacity, the potential for shrinking and swelling, and moderately slow permeability. Mulching, fertilizing, and irrigating are needed to establish lawn grasses and other small seeded plants.

If buildings are constructed on the soil in this unit, properly designing foundations and footings and diverting runoff away from buildings help to prevent structural damage as a result of shrinking and swelling. Buildings and roads should be designed to offset the limited ability of the soil to support a load.

If septic tank absorption fields are used, the limitation of moderately slow permeability can be overcome by increasing the size of the absorption field.

This map unit is in capability subclasses IIc(21), irrigated, and IIIc(21), nonirrigated.

190—Medford clay loam, cool, 2 to 5 percent slopes. This very deep, moderately well drained soil is on alluvial fans. It formed in alluvium derived from mixed rock sources. The vegetation in areas not cultivated is mainly perennial grasses, forbs, shrubs, and scattered oak. Elevation is 2,200 to 4,000 feet. The average annual precipitation is about 18 inches, the average

annual air temperature is about 50 degrees F, and the average frost-free period is about 125 days.

Typically, the surface layer is very dark grayish brown clay loam about 18 inches thick. The upper 23 inches of the subsoil is dark brown and yellowish brown clay. The lower 8 inches is yellowish brown clay loam. The substratum to a depth of 60 inches or more is yellowish brown clay loam.

Included in this unit are small areas of Dotta loam, Jenny clay, and a soil that is similar to this Medford soil but is moderately alkaline and calcareous throughout. Included areas make up about 20 percent of the total acreage.

Permeability of this Medford soil is moderately slow. Available water capacity is high to very high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for cultivated crops, hay and pasture, rangeland, and homesite development.

This unit is suited to irrigated and nonirrigated wheat and barley. It has few limitations. Furrow, border, corrugation, and sprinkler irrigation systems are suited to the unit. The method used generally is governed by the crop grown. If furrow or corrugation irrigation systems are used, runs should be on the contour or across the slope. If sprinkler irrigation is used, water needs to be applied slowly to minimize runoff. Water should be applied at a slow rate over a long period to insure that the root zone is properly wetted.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures increase fertility and tilth.

This unit is suited to hay and pasture. It has few limitations. Proper grazing practices, weed control, and fertilizer are needed for maximum quality of forage. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff.

This unit is suited to use as rangeland. It has few limitations. The soil in the unit responds well to fertilizer, to range seeding, and to proper grazing use. Grazing should be delayed until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.

The potential plant community on this unit includes bottlebrush squirreltail, Thurber needlegrass, and western juniper.

This unit is suited to homesite development. The main limitations are load supporting capacity, the potential for shrinking and swelling, and moderately slow permeability. Buildings and roads should be designed to offset the limited ability of the soil in the unit to support a load. If buildings are constructed on the soil, properly designing foundations and footings and diverting runoff away from buildings help to prevent structural damage as a result of shrinking and swelling.

If septic tank absorption fields are used, the limitation of moderately slow permeability can be overcome by increasing the size of the absorption field.

Mulching, fertilizing, and irrigating are needed to establish lawn grasses and other small seeded plants.

This map unit is in capability units 11e-1(21), irrigated, and 11e-1(21), nonirrigated.

191—Medford clay loam, cool, 5 to 15 percent slopes. This very deep, moderately well drained, rolling soil is on alluvial fans. It formed in alluvium derived from mixed rock sources. The vegetation in areas not cultivated is mainly perennial grasses, forbs, shrubs, and scattered oak. Elevation is 2,200 to 4,000 feet. The average annual precipitation is about 18 inches, the average annual air temperature is about 50 degrees F, and the average frost-free period is about 125 days.

Typically, the surface layer is very dark grayish brown clay loam about 18 inches thick. The upper 23 inches of the subsoil is dark brown and yellowish brown clay. The lower 8 inches is yellowish brown clay loam. The substratum to a depth of 60 inches or more is yellowish brown clay loam.

Included in this unit are small areas of Dotta loam, Jenny clay, and a soil that is similar to this Medford soil but is moderately alkaline and calcareous throughout. Included areas make up about 20 percent of the total acreage.

Permeability of this Medford soil is moderately slow. Available water capacity is high to very high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for cultivated crops, hay and pasture, rangeland, and homesite development.

This unit is suited to irrigated and nonirrigated wheat and barley. It is limited mainly by slope. Sprinkler or contour ditch irrigation is suited to the soil in the unit. The method used generally is governed by the crop grown. Pipe, ditch lining, or drop structures should be installed in irrigation ditches to facilitate irrigation and prevent excessive ditch erosion. Irrigation water should be applied at a rate that insures optimum production without increasing runoff, deep percolation, and erosion.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. All tillage should be on the contour or across the slope.

This unit is suited to hay and pasture. It has few limitations. Proper grazing practices, weed control, and fertilizer are needed for maximum quality of forage. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff.

This unit is suited to use as rangeland. It has few limitations. The soil in the unit responds well to fertilizer, to range seeding, and to proper grazing use. Grazing should be delayed until the soil has drained sufficiently and is firm enough to withstand trampling by livestock. If the shrubs are managed to create open areas, the soil produces a good stand of desirable grasses and forbs.

The potential plant community on this unit includes bottlebrush squirreltail, Thurber needlegrass, and western juniper.

This unit is suited to homesite development. The main limitations are load supporting capacity, the potential for shrinking and swelling, moderately slow permeability, and slope. Only the part of the site that is used for construction should be disturbed.

Plans for homesite development should provide for the preservation of as many trees as possible. Establishing and maintaining plant cover can be achieved through proper fertilizing, seeding, mulching, and shaping of the slopes.

If septic tank absorption fields are used, the limitation of moderately slow permeability can be overcome by increasing the size of the absorption field. The steepness of slope is a concern in installing septic tank absorption fields. Absorption lines should be installed on the contour.

If buildings are constructed on the soil in this unit, properly designing foundations and footings and diverting runoff away from buildings help to prevent structural damage as a result of shrinking and swelling. Buildings and roads should be designed to offset the limited ability of the soil to support a load.

This map unit is in capability unit IIIe-1(21), irrigated and nonirrigated.

192—Montague clay, 0 to 2 percent slopes. This moderately deep, well drained soil is on terraces. It formed in alluvium derived from extrusive igneous rock. The vegetation in areas not cultivated is mainly perennial grasses, forbs, and shrubs. Elevation is 2,500 to 3,000 feet. The average annual precipitation is about 13 inches, the average annual air temperature is about 50 degrees F, and the average frost-free period is about 125 days.

Typically, the surface layer is dark gray and brown clay about 24 inches thick. The next layer is a strongly cemented hardpan about 12 inches thick. Weathered rock is at a depth of 36 inches.

Included in this unit are small areas of Lassen clay, Kuck clay loam, Medford clay loam, Montague Variant clay, soils that are covered by stones, and Rock outcrop, all of which have slopes of as much as 9 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Montague soil is slow. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches and is limited by the hardpan. The depth to bedrock is 30 to 48 inches. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for cultivated crops, hay and pasture, rangeland, and urban development.

This unit is suited to irrigated and nonirrigated wheat and barley. It is limited mainly by slow permeability and depth to the hardpan. Tillage should be performed when

the moisture content is about 50 percent of field capacity. Tillth and fertility can be improved by returning crop residue to the soil. Tillage should be kept to a minimum.

Furrow, border, and corrugation irrigation systems are suited to the soil in this unit. Because of the slow permeability of the soil, the application of water should be regulated so that water does not stand on the surface.

This unit is suited to hay and pasture. Grazing when the soil is wet results in compaction of the surface layer, poor tillth, and excessive runoff. Proper grazing practices, weed control, and fertilizer are needed for maximum quality of forage. Irrigation water can be applied by the border and corrugation methods.

This unit is suited to use as rangeland. The production of vegetation suitable for livestock grazing is limited by the potential for shrinking and swelling. Plants that tolerate high shrink-swell potential should be seeded. The soil in this unit responds well to fertilizer, to range seeding, and to proper grazing use. Grazing should be delayed until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.

The potential plant community on this unit includes bluebunch wheatgrass, beardless wheatgrass, Idaho fescue, and sulphurflower.

This unit is suited to urban development. The main limitations are the depth to the hardpan and bedrock, the potential for shrinking and swelling, load supporting capacity, and slow permeability. The hardpan is rippable and therefore is not a serious limitation for most engineering uses; however, the bedrock underlying the hardpan is a continuing problem.

If the soil in this unit is used for septic tank absorption fields, the limitations of moderate depth to rock and slow permeability can be partially overcome by increasing the size of the absorption field.

Mulching, fertilizing, and irrigating are needed to establish lawn grasses and other small seeded plants.

Buildings and roads should be designed to offset the limited ability of the soil in this unit to support a load. If buildings are constructed on the soil, properly designing foundations and footings and diverting runoff away from buildings help to prevent structural damage as a result of shrinking and swelling.

This map unit is in capability unit IIIs-5(21), irrigated and nonirrigated.

193—Montague clay, 2 to 9 percent slopes. This moderately deep, well drained soil is on terraces. It formed in alluvium derived from extrusive igneous rock. The vegetation in areas not cultivated is mainly perennial grasses, forbs, and shrubs. Elevation is 2,500 to 3,000 feet. The average annual precipitation is about 13 inches, the average annual air temperature is about 50 degrees F, and the average frost-free period is about 125 days.

Typically, the surface layer is dark gray and brown clay about 24 inches thick. The next layer is a strongly cemented hardpan about 12 inches thick. Weathered rock is at a depth of 36 inches. Depth to bedrock ranges from 30 to 40 inches.

Included in this unit are small areas of Lassen clay, Kuck clay loam, Medford clay loam, Montague Variant clay, soils that are covered with stones, and Rock outcrop. Included areas make up about 10 percent of the total acreage.

Permeability of this Montague soil is slow. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for cultivated crops, hay and pasture, rangeland, and urban development.

This unit is suited to irrigated and nonirrigated wheat and barley. It is limited mainly by slow permeability, the depth to the hardpan and bedrock, and the hazard of erosion. Furrow, border, corrugation, and contour ditch irrigation systems are suited to the soil in this unit. Because of the slow permeability of the soil, the application of water should be regulated so that water does not stand on the surface. Irrigation water should be applied at a rate that insures optimum production without increasing runoff, deep percolation, and erosion. Also, waterways should be shaped and seeded to perennial grass.

Tilth and fertility can be improved by returning crop residue to the soil. Tillage should be performed when the moisture content is about 50 percent of field capacity. It should be kept to a minimum.

This unit is suited to hay and pasture. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Proper grazing practices, weed control, and fertilizer are needed for maximum quality of forage. Irrigation water can be applied by the border and contour ditch methods.

This unit is suited to use as rangeland. The production of vegetation suitable for livestock grazing is limited by the potential for shrinking and swelling. The soil in this unit responds well to fertilizer, to range seeding, and to proper grazing use. Plants that tolerate high shrink-swell potential should be seeded. Grazing should be delayed until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.

The potential plant community on this unit includes bluebunch wheatgrass, beardless wheatgrass, Idaho fescue, and sulphurflower.

This unit is suited to urban development. The main limitations are slow permeability, the potential for shrinking and swelling, depth to the hardpan and bedrock, and load supporting capacity.

The suitability of the soil in this unit for septic tank absorption fields is limited by the moderate depth to the hardpan and bedrock and by slow permeability. These

limitations can be overcome by increasing the size of the filter field.

Mulching, fertilizing, and irrigating are needed to establish lawn grasses and other small seeded plants.

Buildings and roads should be designed to offset the limited ability of the soil in this unit to support a load. If buildings are constructed, properly designing foundations and footings and diverting runoff away from buildings help to prevent structural damage as a result of shrinking and swelling.

This map unit is in capability unit IIIe-5(21), irrigated and nonirrigated.

194—Montague cobbly clay, 0 to 9 percent slopes.

This moderately deep, well drained soil is on terraces. It formed in alluvium derived from extrusive igneous rock. The vegetation in areas not cultivated is mainly perennial grasses, forbs, and shrubs. Elevation is 2,500 to 3,000 feet. The average annual precipitation is about 13 inches, the average annual air temperature is about 50 degrees F, and the average frost-free period is about 125 days.

Typically, the surface layer is dark gray and brown cobbly clay about 24 inches thick. The next layer is a strongly cemented hardpan about 12 inches thick. Weathered rock is at a depth of 36 inches. Depth to rock ranges from 30 to 48 inches. A few cobbles are on the surface in most places.

Included in this unit are small areas of Lassen clay, Kuck clay loam, Medford clay loam, Montague Variant clay, soils that are covered with stones, and Rock outcrop. Included areas make up about 20 percent of the total acreage.

Permeability of this Montague soil is slow. Available water capacity is very low to low. Effective rooting depth to the hardpan is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

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

This unit is poorly suited to irrigated hay and pasture. The main limitations are cobbles on the surface and slow permeability.

Irrigation water can be applied by the border and contour ditch methods. Because of the slow permeability of the soil in this unit, the application of irrigation water should be regulated so that water does not stand on the surface.

Use of proper stocking rates, pasture rotation, and restricted grazing during wet periods helps to keep the pasture in good condition and to protect the soil from erosion. Proper grazing practices, weed control, and fertilizer are needed for maximum quality of forage. The use of equipment is limited by cobbles on the surface.

This unit is suited to use as rangeland. The main limitations are cobbles on the surface, slow permeability, and the potential for shrinking and swelling. The soil in this unit responds well to fertilizer and to proper grazing

use. Plants that tolerate a high shrink-swell potential should be seeded. Grazing should be delayed until the soil has drained sufficiently and is firm enough to withstand trampling by livestock. Use of mechanical treatment practices is not practical, because the surface is cobbly.

The potential plant community on this unit is mainly beardless wheatgrass, bluebunch wheatgrass, bottlebrush squirreltail, and Idaho fescue.

This unit is suited to urban development. The main limitations are slow permeability, the potential for shrinking and swelling, depth to the hardpan and bedrock, load supporting capacity, and cobbles on the surface.

The suitability of the soil in this unit for septic tank absorption fields is limited by the depth to the hardpan and bedrock and slow permeability. These limitations can be overcome by increasing the size of the absorption field.

Removal of pebbles and cobbles in disturbed areas is required for best results when landscaping, particularly in areas used for lawns. Mulching, fertilizing, and irrigating are needed to establish lawn grasses and other small seeded plants.

Buildings and roads should be designed to offset the limited ability of the soil in this unit to support a load. If buildings are constructed on the soil, properly designing foundations and footings and diverting runoff away from buildings help to prevent structural damage as a result of shrinking and swelling.

This map unit is in capability unit IVe-7(21), irrigated and nonirrigated.

195—Montague Variant clay, 0 to 9 percent slopes.

This shallow, well drained soil is on terraces. It formed in alluvium derived from extrusive igneous rock. The vegetation in areas not cultivated is mainly perennial grasses, forbs, and shrubs. Elevation is 2,500 to 3,000 feet. The average annual precipitation is about 13 inches, the average annual air temperature is about 50 degrees F, and the average frost-free period is about 125 days.

Typically, the surface layer is grayish brown clay about 12 inches thick. The next layer is a very strongly lime cemented hardpan about 3 inches thick. Weathered rock is at a depth of 15 inches. Depth to rock ranges from 15 to 44 inches.

Included in this unit are small areas of Lassen clay, Kuck clay loam, Medford clay loam, Montague clay, and Rock outcrop. Included areas make up about 20 percent of the total acreage.

Permeability of this Montague Variant soil is slow. Available water capacity is very low to low. Effective rooting depth to the hardpan is 10 to 20 inches. Runoff is medium, and the hazard of water erosion is moderate.

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

This unit is suited to hay and pasture. The main limitations are slow permeability and the depth to the hardpan.

Irrigation water can be applied by the border and contour ditch methods. Because of the slow permeability of the soil in this unit, the application of water should be regulated so that the water does not stand on the surface.

Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Proper grazing practices, weed control, and fertilizer are needed for maximum quality of forage.

This unit is suited to use as rangeland. The production of vegetation suitable for livestock grazing is limited by the potential for shrinking and swelling, susceptibility of the soil to compaction, and shallow depth to rock. The soil in this unit responds well to fertilizer, to range seeding, and to proper grazing use. Plants that tolerate shrinking and swelling should be seeded. Grazing should be delayed until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.

The potential plant community on this unit includes bottlebrush squirreltail, bluebunch wheatgrass, and big sagebrush.

This unit is suited to urban development. The main limitations are slow permeability, the potential for shrinking and swelling, depth to the hardpan and bedrock, and load supporting capacity. The suitability of the soil for septic tank absorption fields is limited by the depth to the hardpan and bedrock and slow permeability. These limitations can be overcome by increasing the size of the filter field.

Buildings and roads should be designed to offset the limited ability of the soil in this unit to support a load. If buildings are constructed on the soil, properly designing foundations and footings and diverting runoff away from buildings help to prevent structural damage as a result of shrinking and swelling.

Mulching, fertilizing, and irrigating are needed to establish lawn grasses and other small seeded plants.

This map unit is in capability unit VIe-5(21), irrigated and nonirrigated.

196—Neer-Ponto stony sandy loams, 15 to 50 percent slopes.

This map unit is on hills. The native vegetation is mainly mixed conifers and brush. Elevation is 2,700 to 5,000 feet. The average annual precipitation is about 40 inches, the average annual air temperature is about 48 degrees F, and the average frost-free period is about 125 days.

This unit is 45 percent Neer stony sandy loam and 35 percent Ponto stony sandy loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of a soil that is similar to the Ponto soil but is very gravelly throughout, soils that are covered with stones, Rock outcrop, and

soils that are similar to the Neer and Ponto soils but have slopes of more than 50 percent. Included areas make up about 20 percent of the total acreage.

The Neer soil is moderately deep and well drained. It formed in volcanic ash. Typically, the surface is covered with a mat of undecomposed and partially decomposed needles, leaves, twigs, bark, and other organic debris about 2 inches thick. The surface layer is dark brown and yellowish brown stony sandy loam about 9 inches thick. The subsoil is light yellowish brown very gravelly sandy loam about 17 inches thick. Extrusive igneous rock is at a depth of 26 inches.

Permeability of this Neer soil is rapid. Available water capacity is very low to low. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

The Ponto soil is very deep and well drained. It formed in volcanic ash. Typically, the surface is covered with a mat of undecomposed and partially decomposed needles, leaves, twigs, bark, and other organic debris about 1 inch thick. The surface layer is very dark grayish brown and brown stony sandy loam about 8 inches thick. The subsoil is light brown, pink, and very pale brown sandy loam about 45 inches thick. The substratum to a depth of 80 inches or more is light brown stony sandy loam. A few stones are on the surface in most places.

Permeability of the Ponto soil is moderate. Available water capacity is moderate to high. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

This unit is used as woodland and for livestock grazing.

The Neer soil is suited to the production of ponderosa pine, Douglas-fir, and white fir. It can produce about 2,998 cubic feet, or 13,460 board feet (Scribner rule), of timber per acre from a fully stocked stand of even-aged ponderosa pine trees 80 years old.

The main concerns in producing and harvesting timber are the hazard of erosion, equipment limitations, plant competition, and seedling mortality. Conventional methods of harvesting trees can be used, but stones on the surface can interfere with felling, yarding, and other operations involving the use of equipment. Management that minimizes the risk of erosion is essential in harvesting timber. Proper design of road drainage systems and care in the placement of culverts help to control erosion. Spoil from excavations is subject to rill and gully erosion and to sloughing.

Reforestation must be carefully managed to reduce competition from undesirable understory plants. If site preparation is not adequate, plant competition can prevent or prolong natural or artificial reestablishment of trees. The very low to low available water capacity generally influences seedling survival in areas where understory plants are numerous. Among the trees that are suitable for planting are Douglas-fir and white fir.

When the density of the forest canopy is less than about 40 percent, the Neer soil produces grazable understory. The understory includes manzanita, snowbrush ceanothus, serviceberry, needlegrass, and sierra chinquapin. Livestock grazing should be managed to protect the soil from excessive erosion.

The Ponto soil is suited to the production of ponderosa pine, Douglas-fir, and incense-cedar. It can produce about 7,880 cubic feet, or 37,110 board feet (Scribner rule), of timber per acre from a fully stocked stand of even-aged ponderosa pine trees 80 years old.

The main concerns in producing and harvesting timber are the hazard of erosion, equipment limitations, and plant competition. Conventional methods of harvesting trees can be used, but stones on the surface can interfere with felling, yarding, and other operations involving the use of equipment. Management that minimizes the risk of erosion is essential in harvesting timber. Proper design of road drainage systems and care in the placement of culverts help to control erosion. Spoil from excavations is subject to rill and gully erosion and to sloughing.

Reforestation must be carefully managed to reduce competition from undesirable understory plants. If site preparation is not adequate, plant competition can prevent or prolong natural or artificial reestablishment of trees. Among the trees that are suitable for planting are ponderosa pine and Douglas-fir.

When the density of the forest canopy is less than about 40 percent, the Ponto soil produces grazable understory. The understory includes manzanita, whitethorn ceanothus, bitter cherry, and snowbrush ceanothus. Livestock grazing should be managed to protect the soil from excessive erosion.

This map unit is in capability subclass VIe(22), nonirrigated.

197—Neer-Ponto complex, 15 to 50 percent slopes. This map unit is on hills. The native vegetation is mainly mixed conifers and brush. Elevation is 2,700 to 5,000 feet. The average annual precipitation is about 40 inches, the average annual air temperature is about 48 degrees F, and the average frost-free period is about 125 days.

This unit is 50 percent Neer gravelly sandy loam and 35 percent Ponto sandy loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of a soil that is similar to the Ponto soil but is very gravelly throughout, Rock outcrop, and soils that have slopes of more than 50 percent. Included areas make up about 15 percent of the total acreage.

The Neer soil is moderately deep and well drained. It formed in volcanic ash. Typically, the surface is covered with a mat of undecomposed and partially decomposed needles, leaves, twigs, bark, and other organic debris

about 2 inches thick. The surface layer is dark brown and yellowish brown gravelly sandy loam about 9 inches thick. The subsoil is light yellowish brown very gravelly sandy loam about 17 inches thick. Extrusive igneous rock is at a depth of 26 inches.

Permeability of this Neer soil is rapid. Available water capacity is very low to low. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

The Ponto soil is very deep and well drained. It formed in volcanic ash. Typically, the surface is covered with a mat of undecomposed and partially decomposed needles, leaves, twigs, bark, and other organic debris about 1 inch thick. The surface layer is very dark grayish brown and brown sandy loam about 8 inches thick. The subsoil is light brown, pink, and very pale brown sandy loam about 45 inches thick. The substratum to a depth of 80 inches or more is light brown stony sandy loam.

Permeability of the Ponto soil is moderate. Available water capacity is low to moderate. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

This unit is used as woodland and for livestock grazing.

The Neer soil is suited to the production of ponderosa pine, Douglas-fir, and white fir. It can produce about 2,998 cubic feet, or 13,460 board feet (Scribner rule), of timber per acre from a fully stocked stand of even-aged ponderosa pine trees 80 years old.

The main concerns in producing and harvesting timber are the hazard of erosion, equipment limitations, and plant competition. Conventional methods of harvesting trees can be used. Management that minimizes the risk of erosion is essential in harvesting timber. Proper design of road drainage systems and care in the placement of culverts help to control erosion. Spoil from excavations is subject to rill and gully erosion and to sloughing.

Reforestation must be carefully managed to reduce competition from undesirable understory plants. If site preparation is not adequate, competition from such plants can prevent or prolong natural or artificial reestablishment of trees. The very low to low available water capacity generally influences seedling survival in areas where understory plants are numerous. Among the trees that are suitable for planting are Douglas-fir and white fir.

When the density of the forest canopy is less than about 40 percent, the Neer soil produces grazable understory. The understory includes manzanita, needlegrass, antelope bitterbrush, and serviceberry. Livestock grazing should be managed to protect the soil from excessive erosion.

The Ponto soil is suited to the production of ponderosa pine, Douglas-fir, and incense-cedar. It can produce about 7,880 cubic feet, or 37,110 board feet

(Scribner rule), of timber per acre from a fully stocked stand of even-aged ponderosa pine trees 80 years old.

The main concerns in producing and harvesting timber are the hazard of erosion, equipment limitations, and plant competition. Conventional methods of harvesting trees can be used. Management that minimizes the risk of erosion is essential in harvesting timber. Proper design of road drainage systems and care in the placement of culverts help to control erosion. Spoil from excavations is subject to rill and gully erosion and to sloughing.

Reforestation must be carefully managed to reduce competition from undesirable understory plants. If site preparation is not adequate, competition from such plants can prevent or prolong natural or artificial reestablishment of trees. Among the trees that are suitable for planting are ponderosa pine and Douglas-fir.

When the density of the forest canopy is less than about 40 percent, the Ponto soil produces grazable understory. The understory includes manzanita, sierra chinquapin, whitethorn ceanothus, and bitter cherry. Livestock grazing should be managed to protect the soil from excessive erosion.

This map unit is in capability subclass VIe(22), nonirrigated.

198—Odas sandy loam. This very deep, poorly drained soil is on flood plains. It formed in alluvium derived dominantly from extrusive igneous rock. Slope is 0 to 2 percent. The vegetation in areas not cultivated is mainly perennial grasses, sedges, and other water-tolerant plants. Elevation is 2,500 to 4,500 feet. The average annual precipitation is about 40 inches, the average annual air temperature is about 48 degrees F, and the average frost-free period is about 125 days.

Typically, the surface layer is dark grayish brown sandy loam about 31 inches thick. The upper 10 inches of the underlying material is grayish brown sandy loam. The lower part to a depth of 60 inches or more is light brownish gray and gray sandy loam.

Included in this unit are small areas of Settlemyer loam, Diyou loam, and a soil that is similar to this Odas soil but has a water table at a depth of 36 to 60 inches in summer. Included areas make up about 15 percent of the total acreage.

Permeability of this Odas soil is moderately rapid. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. A water table is at a depth of 18 to 36 inches throughout the year. This soil is subject to rare periods of flooding.

This unit is used for dryland hay and pasture, rangeland, and homesite development.

This unit is suited to dryland hay and pasture. The main limitation is wetness. Proper grazing practices, weed control, and fertilizer are needed for maximum quality of forage. Grazing when the soil is wet results in

compaction of the surface layer, poor tilth, and excessive runoff.

This unit is suited to use as rangeland. The production of vegetation suitable for livestock grazing is limited by wetness. The soil in this unit responds well to fertilizer, to range seeding, and to proper grazing use. Plants that tolerate wetness should be seeded. Grazing should be delayed until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.

The potential plant community on this unit includes carex, redtop, tufted hairgrass, and bluegrass.

This unit is poorly suited to homesite development. The main limitations are the high water table and the hazard of flooding. Septic tank absorption fields do not function properly because of the high water table. Flooding can be controlled only by use of major flood control structures. Landscaping plants that tolerate a high water table should be selected if drainage is not provided.

This map unit is in capability unit IIIw-2(21), nonirrigated.

199—Oosen loamy sand, 2 to 15 percent slopes.

This very deep, somewhat excessively drained soil is on mountains. It formed in volcanic ash. The native vegetation is mainly mixed conifers, shrubs, perennial grasses, and forbs. Elevation is 5,000 to 7,000 feet. The average annual precipitation is about 40 inches, the average annual air temperature is about 41 degrees F, and the average frost-free period is about 50 days.

Typically, the surface is covered with a mat of undecomposed and partially decomposed needles, leaves, twigs, bark, and other organic debris about 1/4 inch thick. The surface layer is dark brown and light yellowish brown loamy sand about 12 inches thick. The upper 16 inches of the underlying material is yellowish brown loamy sand. The lower part to a depth of 72 inches is dark brown sand.

Included in this unit are small areas of Avis soils, Iller stony sandy loam, a Sheld very stony sandy loam that has slopes of 50 to 65 percent, Rock outcrop, and soils that are similar to this Oosen soil but have slopes of more than 15 percent. Included areas make up about 20 percent of the total acreage.

Permeability of this Oosen soil is rapid. Available water capacity is low to moderate. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland and for livestock grazing.

This unit is suited to the production of ponderosa pine, white fir, and Douglas-fir. It can produce about 6,248 cubic feet, or 29,280 board feet (Scribner rule), of timber per acre from a fully stocked stand of even-aged ponderosa pine trees 80 years old.

The main concerns in producing and harvesting timber are seedling mortality and plant competition. If site

preparation is not adequate, competition from undesirable plants can prevent or prolong natural or artificial reestablishment of trees. Reforestation must be carefully managed to reduce competition from such plants. The low to moderate available water capacity generally influences seedling survival in areas where understory plants are numerous. Proper site preparation controls initial plant competition, and spraying controls subsequent growth. Among the trees that are suitable for planting are white fir and California red fir.

The understory includes sierra chinquapin and greenleaf manzanita.

This map unit is in capability subclass VIe(22), nonirrigated.

200—Orset sandy loam, 0 to 9 percent slopes. This very deep, well drained soil is on terraces. It formed in alluvium derived dominantly from extrusive igneous rock. The native vegetation is mainly mixed conifers, perennial grasses, forbs, and shrubs. Elevation is 4,500 to 6,000 feet. The average annual precipitation is about 40 inches, the average annual air temperature is about 43 degrees F, and the average frost-free period is 65 days.

Typically, the surface is covered with a mat of undecomposed and partially decomposed needles, leaves, twigs, bark, and other organic debris about 1/2 inch thick. The surface layer is grayish brown and pale brown sandy loam about 13 inches thick. The underlying material to a depth of 60 inches or more is very pale brown loam. Below a depth of about 42 inches the underlying material is weakly to moderately cemented by silica.

Included in this unit are small areas of an Avis stony sandy loam that has slopes of 0 to 5 percent, an Iller stony sandy loam that has slopes of 0 to 9 percent, Rock outcrop, and soils that have slopes of more than 9 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Orset soil is moderately slow. Available water capacity is moderate to high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland and for livestock grazing.

This unit is suited to the production of ponderosa pine, Douglas-fir, and white fir. It can produce about 2,720 cubic feet, or 12,200 board feet (Scribner rule), of timber per acre from a fully stocked stand of even-aged ponderosa pine trees 80 years old.

The main concerns in producing and harvesting timber are seedling mortality and plant competition. If site preparation is not adequate, competition from undesirable plants can prevent or prolong natural or artificial reestablishment of trees. Reforestation must be carefully managed to reduce competition from such plants. Proper site preparation controls initial plant competition, and spraying controls subsequent growth.

Among the trees that are suitable for planting are Douglas-fir and ponderosa pine.

When the density of the forest canopy is less than about 40 percent, the soil in this unit produces grazable understory vegetation. The understory vegetation includes bottlebrush squirreltail, needlegrass, and antelope bitterbrush.

This map unit is in capability unit IVe-1(22), nonirrigated.

201—Pinehurst stony loam, 2 to 15 percent slopes.

This deep, well drained soil is on mountains. It formed in residuum derived dominantly from extrusive igneous rock. The native vegetation is mainly mixed conifers, shrubs, and forbs. Elevation is 4,000 to 6,000 feet. The average annual precipitation is about 30 inches, the average annual air temperature is about 46 degrees F, and the average frost-free period is about 90 days.

Typically, the surface is covered with a mat of undecomposed and partially decomposed needles, leaves, twigs, bark, and other organic debris about 1 inch thick. The surface layer is dark brown stony loam about 10 inches thick. The upper 38 inches of the subsoil is reddish brown gravelly loam and dark brown gravelly clay loam. The lower 12 inches is dark brown very stony clay loam. Weathered bedrock is at a depth of 60 inches. A few stones are on the surface in most places.

Included in this unit are small areas of a soil that is similar to this Pinehurst soil but is underlain by extrusive igneous rock at a depth of 10 to 20 inches, Plutos loamy sand, Rock outcrop, and soils that have slopes of more than 15 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Pinehurst soil is moderately slow. Available water capacity is low. Effective rooting depth is 40 to 60 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland and for livestock grazing.

This unit is suited to the production of Douglas-fir, ponderosa pine, and white fir. It can produce about 3,415 cubic feet, or 15,350 board feet (Scribner rule), of timber per acre from a fully stocked stand of even-aged ponderosa pine trees 80 years old.

The main concern in producing and harvesting timber is plant competition. If site preparation is not adequate, competition from undesirable plants can prevent or prolong natural or artificial reestablishment of trees. Competing vegetation can be controlled by proper site preparation and by spraying, cutting, or girdling to eliminate unwanted weeds, brush, or trees. Among the trees that are suitable for planting are Douglas-fir, ponderosa pine, and white fir.

When the density of the forest canopy is less than about 40 percent, the soil in this unit produces grazable

understory. The understory includes deerbrush, snowbrush ceanothus, snowberry, and Idaho fescue.

This map unit is in capability unit IVe-7(22), nonirrigated.

202—Pinehurst stony loam, 15 to 30 percent slopes.

This deep, well drained soil is on mountains. It formed in residuum derived dominantly from extrusive igneous rock. The native vegetation is mainly mixed conifers, shrubs, and forbs. Elevation is 4,000 to 6,000 feet. The average annual precipitation is about 30 inches, the average annual air temperature is about 46 degrees F, and the average frost-free period is about 90 days.

Typically, the surface is covered with a mat of undecomposed and partially decomposed needles, leaves, twigs, bark, and other organic debris about 1 inch thick. The surface layer is dark brown stony loam about 10 inches thick. The upper 38 inches of the subsoil is reddish brown gravelly loam and dark brown gravelly clay loam. The lower 12 inches is dark brown very stony clay loam. Unweathered bedrock is at a depth of 60 inches or more. A few stones are on the surface in most places.

Included in this unit are small areas of a soil that is similar to this Pinehurst soil but is underlain by extrusive igneous rock at a depth of 10 to 20 inches, Plutos loamy sand, and soils that have slopes of more than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Pinehurst soil is moderately slow. Available water capacity is low to high. Effective rooting depth is 40 to 60 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used as woodland and for livestock grazing.

This unit is moderately suited to the production of Douglas-fir, ponderosa pine, and white fir. It can produce about 3,415 cubic feet, or 15,350 board feet (Scribner rule), of timber per acre from a fully stocked stand of even-aged Douglas-fir trees 80 years old.

The main concerns in producing and harvesting timber are the hazard of erosion and plant competition. Spoil from excavations is subject to rill and gully erosion and to sloughing. Proper design of road drainage systems and care in the placement of culverts help to control erosion. If site preparation is not adequate, competition from undesirable plants can prevent or prolong natural or artificial reestablishment of trees. Proper site preparation controls initial plant competition, and spraying controls subsequent growth. Among the trees that are suitable for planting are Douglas-fir, ponderosa pine, and white fir.

When the density of the forest canopy is less than about 40 percent, the soil in this unit produces grazable understory. The understory includes deerbrush, snowbrush ceanothus, snowberry, and Idaho fescue.

This map unit is in capability unit IVe-7(22), nonirrigated.

203—Pinehurst stony loam, 30 to 50 percent slopes. This deep, well drained soil is on mountains. It formed in residuum derived dominantly from extrusive igneous rock. The native vegetation is mainly mixed conifers, shrubs, and forbs. Elevation is 4,000 to 6,000 feet. The average annual precipitation is about 30 inches, the average annual air temperature is about 46 degrees F, and the average frost-free period is about 90 days.

Typically, the surface is covered with a mat of undecomposed and partially decomposed needles, leaves, twigs, bark, and other organic debris about 1 inch thick. The surface layer is dark brown stony loam about 10 inches thick. The upper 38 inches of the subsoil is reddish brown and dark brown gravelly loam and gravelly clay loam. The lower 12 inches is dark brown clay loam. Weathered bedrock is at a depth of 60 inches. A few stones are on the surface in most places.

Included in this unit are small areas of a soil that is similar to this Pinehurst soil but is underlain by extrusive igneous rock at a depth of 10 to 40 inches, Rock outcrop, and soils that have slopes of more than 50 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Pinehurst soil is moderately slow. Available water capacity is low to moderate. Effective rooting depth is 40 to 60 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used as woodland and for livestock grazing.

This unit is suited to the production of Douglas-fir, ponderosa pine, and white fir. It can produce about 3,415 cubic feet, or 15,350 board feet (Scribner rule), of timber per acre from a fully stocked stand of even-aged Douglas-fir trees 80 years old.

The main concerns in producing and harvesting timber are the hazard of erosion, equipment limitations, and plant competition. Conventional methods of harvesting trees can be used. Spoil from excavations is subject to rill and gully erosion and to sloughing. Proper design of road drainage systems and care in the placement of culverts help to control erosion.

If site preparation is not adequate, competition from undesirable plants can prevent or prolong natural or artificial reestablishment of trees. Competing vegetation can be controlled by proper site preparation and by spraying, cutting, or girdling to eliminate unwanted weeds, brush, or trees. Among the trees that are suitable for planting are Douglas-fir, ponderosa pine, and white fir.

When the density of the forest canopy is less than about 40 percent, the soil in this unit produces grazable understory. The understory includes deerbrush, snowbrush ceanothus, snowberry, and Idaho fescue.

Livestock grazing should be managed to protect the soil from excessive erosion.

This map unit is in capability subclass VIe(22), nonirrigated.

204—Pinehurst Variant very stony loam, 0 to 15 percent slopes. This moderately deep, well drained soil is on mountains. It formed in residuum derived dominantly from andesite. The native vegetation is mainly mixed conifers, shrubs, perennial grasses, and forbs. Elevation is 3,000 to 4,000 feet. The average annual precipitation is about 30 inches, the average annual air temperature is about 46 degrees F, and the average frost-free period is about 90 days.

Typically, the surface layer is dark brown and dark reddish brown very stony loam about 12 inches thick. The subsoil is dark reddish brown very cobbly clay loam about 14 inches thick. Weathered rock is at a depth of 26 inches. Many stones are on the surface in most places.

Included in this unit are small areas of Kuck clay loam, Lassen clay, Rock outcrop, and a soil that is similar to this Pinehurst Variant soil but has slopes of 15 to 30 percent. Included areas make up about 30 percent of the total acreage.

Permeability of this Pinehurst Variant soil is moderately slow. Available water capacity is very low to low. Effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland and for livestock grazing.

This unit is suited to the production of ponderosa pine and Douglas-fir. It can produce about 2,292 cubic feet, or 10,120 board feet (Scribner rule), of timber per acre from a fully stocked stand of even-aged ponderosa pine trees 80 years old.

The main concerns in producing and harvesting timber are stoniness and seedling mortality. Stones on the surface can interfere with felling, yarding, and other operations involving the use of equipment. If site preparation is not adequate, competition from undesirable plants can prevent or prolong natural or artificial reestablishment of trees. Proper site preparation controls initial plant competition, and spraying controls subsequent growth. Among the trees that are suitable for planting are ponderosa pine and Douglas-fir.

When the density of the forest canopy is less than about 40 percent, the soil in this unit produces grazable understory. The understory includes deerbrush, fescue, and bluegrass. Livestock grazing should be managed to protect the soil from excessive erosion.

This map unit is in capability subclass VIi(22), nonirrigated.

205—Pinehurst Variant very stony loam, 15 to 65 percent slopes. This moderately deep, well drained soil is on mountains. It formed in residuum derived

dominantly from andesite. The native vegetation is mainly mixed conifers, shrubs, perennial grasses, and forbs. Elevation is 3,000 to 4,000 feet. The average annual precipitation is about 30 inches, the average annual air temperature is about 46 degrees F, and the average frost-free period is about 90 days.

Typically, the surface layer is dark brown and dark reddish brown very stony loam about 12 inches thick. The subsoil is dark reddish brown very cobbly clay loam about 14 inches thick. Weathered rock is at a depth of 26 inches. Many stones are on the surface in most places.

Included in this unit are small areas of Kuck clay loam, 0 to 15 percent slopes; Lassen clay, 9 to 15 percent slopes; and Rock outcrop. Included areas make up about 20 percent of the total acreage.

Permeability of this Pinehurst Variant soil is moderately slow. Available water capacity is very low to low. Effective rooting depth is 20 to 40 inches. Runoff is rapid to very rapid, and the hazard of water erosion is high to very high.

This unit is used as woodland and for livestock grazing.

This unit is poorly suited to the production of ponderosa pine and Douglas-fir. It can produce about 2,292 cubic feet, or 10,120 board feet (Scribner rule), of timber per acre from a fully stocked stand of even-aged ponderosa pine trees 80 years old.

The main concerns in producing and harvesting timber are the hazard of erosion, equipment limitations, and seedling mortality. Stones on the surface can interfere with felling, yarding, and other operations involving the use of equipment.

Management that minimizes the risk of erosion is essential in harvesting timber. Proper design of road drainage systems and care in the placement of culverts help to control erosion. Spoil from excavations is subject to rill and gully erosion and to sloughing.

If site preparation is not adequate, competition from undesirable plants can prevent or prolong natural or artificial reestablishment of trees. Proper site preparation controls initial plant competition, and spraying controls subsequent growth. Among the trees that are suitable for planting are ponderosa pine and Douglas-fir.

When the density of the forest canopy is less than about 40 percent, the soil in this unit produces grazable understory. The understory includes deerbrush, fescue, and bluegrass. Livestock grazing should be managed to protect the soil from excessive erosion.

This map unit is in capability subclass VIIs(22), nonirrigated.

206—Pit clay. This very deep, poorly drained soil is on flood plains. It formed in alluvium derived dominantly from extrusive igneous rock. Slope is 0 to 2 percent. The vegetation in areas not cultivated is mainly perennial grasses and forbs. Elevation is 2,500 to 4,000 feet. The

average annual precipitation is about 18 inches, the average annual air temperature is about 50 degrees F, and the average frost-free period is about 125 days.

Typically, the surface layer is dark gray clay about 38 inches thick. The underlying material to a depth of 61 inches or more is pale brown clay loam. In some areas the surface layer is silty clay.

Included in this unit is about 20 percent soils that are similar to this Pit clay but have a dark brown or dark grayish brown clay surface layer and are calcareous throughout. Also included is about 15 percent Lassen clay and Montague clay that have slopes of 2 to 5 percent. Included areas make up about 35 percent of the total acreage.

Permeability of this Pit soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. A seasonal high water table is at a depth of 24 to 36 inches from December through May. This soil is subject to long periods of flooding from December through March.

This unit is used for cultivated crops, hay and pasture, and rangeland.

This unit is suited to irrigated and nonirrigated wheat. It is limited mainly by the clayey soil texture, the seasonal high water table, slow permeability, and the hazard of flooding. Tillage should be performed when the moisture content is about 50 percent of field capacity. Tile drainage can be used to lower the water table if a suitable outlet is available.

Furrow, border, and corrugation irrigation systems are suited to the soil in this unit. Because of the slow permeability of the soil, the application of water should be regulated so that water does not stand on the surface and damage the crops.

Returning crop residue to the soil or regularly adding other organic matter improves fertility, reduces crusting, and increases the water intake rate. Tillage should be kept to a minimum.

This unit is suited to hay and pasture. The main limitations are wetness and the hazard of flooding. Wetness limits the choice of plants and the period of cutting or grazing and increases the risk of winterkill. Use of proper stocking rates, pasture rotation, and restricted grazing during wet periods helps to keep the pasture in good condition and to protect the soil from erosion. Proper grazing practices, weed control, and fertilizer are needed for maximum quality of forage.

This unit is suited to use as rangeland. The production of vegetation suitable for livestock grazing is limited by wetness. The soil in this unit responds well to fertilizer, to range seeding, and to proper grazing use. Grazing should be delayed until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.

The potential plant community on this unit includes tufted hairgrass, carex, bluegrasses, and Baltic rush.

This map unit is in capability unit IIIw-5(21), irrigated and nonirrigated.

207—Plutos-Rock outcrop complex, 0 to 30 percent slopes. This map unit is on glacial fans and hills. The native vegetation is mainly perennial grasses, shrubs, and forbs. Elevation is 2,800 to 4,500 feet. The average annual precipitation is about 13 inches, the average annual air temperature is about 50 degrees F, and the average frost-free period is about 125 days.

This unit is 55 percent Plutos loamy sand and 35 percent Rock outcrop. The Plutos soil is in nearly level to moderately sloping areas on glacial fans, and Rock outcrop is in moderately steep areas on hills. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Delaney sand that has slopes of less than 9 percent, Delaney Variant silt that has slopes of less than 2 percent, a soil that is similar to the Plutos soil but is underlain by bedrock at a depth of 10 to 20 inches, and a soil that is similar to the Plutos soil but has slopes of more than 30 percent. Included areas make up about 10 percent of the total acreage.

The Plutos soil is moderately deep and somewhat excessively drained. It formed in glaciofluvial deposits derived dominantly from extrusive igneous rock and volcanic ash. Typically, the surface layer is grayish brown loamy sand about 7 inches thick. The underlying material is light brownish gray and pale brown sand about 16 inches thick. Fractured bedrock is at a depth of 23 inches.

Permeability of the Plutos soil is rapid. Available water capacity is very low. Effective rooting depth is 20 to 40 inches. Runoff is medium to rapid, and the hazard of water erosion is moderate to high. The hazard of soil blowing is moderate.

Rock outcrop consists of exposures of basalt. It supports only a few scattered perennial grasses, which grow in fractures in the rock.

This unit is used as rangeland.

This unit is suited to use as rangeland. The production of vegetation suitable for livestock grazing is limited by droughtiness, the hazards of water erosion and soil blowing, and the areas of Rock outcrop. Livestock grazing should be managed to protect the soil in this unit from excessive erosion. Management practices suitable for use on the soil are proper range use, deferred grazing, and rotation grazing.

The potential plant community on this unit includes western juniper, antelope bitterbrush, manzanita, and big sagebrush.

This map unit is in capability subclass VIIe(21), nonirrigated.

208—Ponto sandy loam, 5 to 15 percent slopes. This very deep, well drained soil is on hills. It formed in volcanic ash. The native vegetation is mainly conifers and brush. Elevation is 2,700 to 5,000 feet. The average annual precipitation is about 40 inches, the average annual air temperature is about 48 degrees F, and the average frost-free period is about 125 days.

Typically, the surface is covered with a mat of undecomposed and partially decomposed needles, leaves, twigs, bark, and other organic debris about 1 inch thick. The surface layer is very dark grayish brown and brown sandy loam about 8 inches thick. The subsoil is light brown, pink, and very pale brown sandy loam about 45 inches thick. The substratum to a depth of 80 inches is light brown stony sandy loam.

Included in this unit are small areas of a soil that is similar to this Ponto soil but is very gravelly throughout, Rock outcrop, and soils that have slopes of more than 15 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Ponto soil is moderate. Available water capacity is moderate or high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland.

This unit is suited to the production of ponderosa pine, Douglas-fir, and incense-cedar. It can produce about 7,880 cubic feet, or 37,110 board feet (Scribner rule), of timber per acre from a fully stocked stand of even-aged ponderosa pine trees 80 years old.

The main concern in producing and harvesting timber is plant competition. If site preparation is not adequate, competition from undesirable plants can prevent or prolong natural or artificial reestablishment of trees. Proper site preparation controls initial plant competition, and spraying controls subsequent growth. Among the trees that are suitable for planting are ponderosa pine and Douglas-fir.

The understory includes manzanita, whitethorn ceanothus, and bitter cherry.

This map unit is in capability unit IIIe-1(22), nonirrigated.

209—Ponto-Neer complex, 2 to 15 percent slopes. This map unit is on hills. The native vegetation is mainly conifers and brush. Elevation is 2,700 to 5,000 feet. The average annual precipitation is about 40 inches, the average annual air temperature is about 48 degrees F, and the average frost-free period is about 125 days.

This unit is 40 percent Ponto sandy loam and 30 percent Neer gravelly sandy loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of a soil that is similar to the Ponto soil but is very gravelly throughout, soils that are covered by stones, Rock outcrop, and soils

that have slopes of more than 15 percent. Included areas make up about 30 percent of the total acreage.

The Ponto soil is very deep and well drained. It formed in volcanic ash. Typically, the surface is covered with a mat of undecomposed and partially decomposed needles, leaves, twigs, bark, and other organic debris about 1 inch thick. Typically, the surface layer is very dark grayish brown and brown sandy loam about 8 inches thick. The subsoil is light brown, pink, and very pale brown sandy loam about 45 inches thick. The substratum to a depth of 80 inches is light brown stony sandy loam.

Permeability of the Ponto soil is moderate. Available water capacity is moderate to high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

The Neer soil is moderately deep and well drained. It formed in volcanic ash. Typically, the surface is covered with a mat of undecomposed and partially decomposed needles, leaves, twigs, bark, and other organic debris about 2 inches thick. The surface layer is dark brown and yellowish brown gravelly sandy loam about 9 inches thick. The subsoil is light yellowish brown very gravelly sandy loam about 17 inches thick. Extrusive igneous rock is at a depth of 26 inches.

Permeability of the Neer soil is rapid. Available water capacity is very low to low. Effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as woodland and for livestock grazing.

The Ponto soil is well suited to the production of ponderosa pine, Douglas-fir, and incense-cedar. It can produce about 7,880 cubic feet, or 37,110 board feet (Scribner rule), of timber per acre from a fully stocked stand of even-aged ponderosa pine trees 80 years old.

The main concern in producing and harvesting timber is plant competition. If site preparation is not adequate, competition from undesirable plants can prevent or prolong natural or artificial reestablishment of trees. Competing vegetation can be controlled by proper site preparation and by spraying, cutting, or girdling to eliminate unwanted weeds, brush, or trees. Among the trees that are suitable for planting are ponderosa pine and Douglas-fir.

When the density of the forest canopy is less than about 40 percent, the Ponto soil produces grazable understory. The understory is mainly manzanita, sierra chinquapin, and whitethorn ceanothus. Livestock grazing should be managed to protect the soil from excessive erosion.

The Neer soil is moderately suited to the production of ponderosa pine, Douglas-fir, and white fir. It can produce about 2,998 cubic feet, or 13,460 board feet (Scribner rule), of timber per acre from a fully stocked stand of even-aged ponderosa pine trees 80 years old.

The main concerns in producing and harvesting timber are plant competition and seedling mortality. If site preparation is not adequate, competition from undesirable plants can prevent or prolong natural or artificial reestablishment of trees. Competing vegetation can be controlled by proper site preparation and by spraying, cutting, or girdling to eliminate unwanted weeds, brush, or trees. The very low or low available water capacity generally influences seedling survival in areas where understory plants are numerous. Among the trees that are suitable for planting are Douglas-fir and white fir.

When the density of the forest canopy is less than about 40 percent, the Neer soil produces grazable understory. The understory includes manzanita, sierra chinquapin, serviceberry, and needlegrass. Livestock grazing should be managed to protect the soil from excessive erosion.

This map unit is in capability unit IVe-1(22), nonirrigated.

210—Redola loam, 0 to 2 percent slopes. This very deep, well drained soil is on alluvial fans. It formed in alluvium derived from mixed rock sources. The vegetation in areas not cultivated is mainly perennial grasses, forbs, and shrubs. Elevation is 2,500 to 4,000 feet. The average annual precipitation is about 13 inches, the average annual air temperature is about 50 degrees F, and the average frost-free period is about 125 days.

Typically, the surface layer is dark grayish brown loam about 13 inches thick. The next layer is dark brown clay loam about 6 inches thick. The upper 20 inches of the underlying material is brown sandy loam and pale brown loam. The lower part to a depth of 60 inches or more is gray gravelly sand.

Included in this unit are small areas of a soil that is similar to this Redola soil but contains slight to moderate concentrations of salt and is strongly alkaline. Also included are small areas of Delaney sand, Delaney Variant soils, and Riverwash. Included areas make up about 15 percent of the total acreage.

Permeability of this Redola soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for cultivated crops, hay and pasture, rangeland, and homesite development.

This unit is suited to irrigated and nonirrigated wheat and barley. It has few limitations. In summer, irrigation is required for maximum production of most crops. Furrow, border, corrugation, and sprinkler irrigation systems are suited to the soil in this unit. The method used generally is governed by the crop grown. Irrigation water should be applied at a rate that insures optimum production without increasing runoff, deep percolation, and erosion.

Leveling is needed in sloping areas for the efficient application and removal of irrigation water.

This unit is suited to hay and pasture. It has few limitations. Proper grazing practices, weed control, and fertilizer are needed for maximum quality of forage. Use of proper stocking rates, pasture rotation, and restricted grazing during wet periods helps to keep the pasture in good condition and to protect the soil from erosion. Irrigation water can be applied by the sprinkler and border methods.

This unit is suited to use as rangeland. It has few limitations. The soil in the unit responds well to fertilizer, to range seeding, and to proper grazing use. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both.

The potential plant community on this unit includes bottlebrush squirreltail, Thurber needlegrass, and redstem filaree.

This unit is suited to homesite development. The main limitation is the moderate permeability. Onsite investigation is needed to properly determine the correct placement of filter lines for septic tank sewage disposal systems. Plans for homesite development should provide for the preservation of as many trees as possible. Mulching, fertilizing, and irrigating help to establish lawn grasses and other small seeded plants.

This map unit is in capability subclasses Ilc(21), irrigated, and Illc(21), nonirrigated.

211—Redola loam, 2 to 9 percent slopes. This very deep, well drained soil is on alluvial fans. It formed in alluvium derived from mixed rock sources. The vegetation in areas not cultivated is mainly perennial grasses, forbs, and shrubs. Elevation is 2,500 to 4,000 feet. The average annual precipitation is about 13 inches, the average annual air temperature is about 50 degrees F, and the average frost-free period is about 125 days.

Typically, the surface layer is dark grayish brown loam about 13 inches thick. The next layer is dark brown clay loam about 6 inches thick. The upper 20 inches of the underlying material is brown sandy loam and pale brown loam. The lower part to a depth of 60 inches or more is gray gravelly sand.

Included in this unit are small areas of a soil that is similar to this Redola soil but contains slight to moderate concentrations of salt and is strongly alkaline. Also included are small areas of Delaney sand, Delaney Variant soils, and Riverwash. Included areas make up about 15 percent of the total acreage.

Permeability of this Redola soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for cultivated crops, hay and pasture, rangeland, and homesite development.

This unit is suited to irrigated and nonirrigated wheat and barley. In summer, irrigation is required for maximum production of most crops. Furrow, border, corrugation, and sprinkler irrigation systems are suited to the soil in this unit. The method used generally is governed by the crop grown. Irrigation water should be applied at a rate that insures optimum production without increasing runoff, deep percolation, and erosion. Leveling is needed in sloping areas for the efficient application and removal of irrigation water.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Erosion can be reduced if fall grain is seeded early, stubble-mulch tillage is used, and tillage and seeding are on the contour or across the slope. Also, waterways should be shaped and seeded to perennial grass.

This unit is suited to hay and pasture. It has few limitations. Proper grazing practices, weed control, and fertilizer are needed for maximum quality of forage. Use of proper stocking rates, pasture rotation, and restricted grazing during wet periods helps to keep the pasture in good condition and to protect the soil from erosion. Irrigation water can be applied by the sprinkler and border methods. Seedbed preparation should be on the contour or across the slope where practical.

This unit is suited to use as rangeland. It has few limitations. The soil in the unit responds well to fertilizer, to range seeding, and to proper grazing use. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both.

The potential plant community on this unit includes bottlebrush squirreltail, Thurber needlegrass, and redstem filaree.

This unit is suited to homesite development. The main limitation is the moderate permeability. Onsite investigation is needed to properly determine the correct placement of filter lines for septic tank sewage disposal systems. Preserving the existing plant cover during construction helps to control erosion. Plans for homesite development should provide for the preservation of as many trees as possible. Mulching, fertilizing, and irrigating are needed to establish lawn grasses and other small seeded plants.

This map unit is in capability units Ile-1(21), irrigated, and Ille-1(21), nonirrigated.

212—Riverwash. This map unit is on the flood plains of major rivers throughout the survey area. It is flooded almost every year. It consists of unstabilized and stratified sandy, silty, clayey, stony, cobbly, and gravelly sediment that is reworked by water about every year. It supports little or no vegetation. Slope is 0 to 5 percent. Drainage is excessive. Areas of this unit are subject to deposition when flooding occurs.

Included in this unit are small areas of Diyou loam, Rock outcrop, and soils that are covered with stones

and boulders. Included areas make up about 25 percent of the mapped acreage.

This unit is used for wildlife habitat and watershed. A few areas are mined for sand and gravel.

This map unit is in capability subclass VIIIw(21), nonirrigated.

213—Rock outcrop-Dubakella complex, 30 to 50 percent slopes. This map unit is on mountains. The native vegetation is mainly mixed conifers, shrubs, forbs, and perennial grasses. Elevation is 2,500 to 5,000 feet. The average annual precipitation is about 35 inches, the average annual air temperature is about 48 degrees F, and the average frost-free period is about 125 days.

This unit is 50 percent Rock outcrop and 30 percent Dubakella stony loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Ipish soils that have a very gravelly loam surface layer, Weitchpec Variant gravelly loam, a soil that is similar to the Dubakella soil but is gravelly clay throughout, and soils that have slopes of more than 50 percent. Included areas make up about 20 percent of the total acreage.

Rock outcrop consists of exposures of bedrock. It does not support vegetation.

The Dubakella soil is moderately deep and well drained. It formed in residuum derived dominantly from serpentine. Typically, the surface is covered with a mat of undecomposed and partially decomposed needles, leaves, twigs, bark, and other organic debris about 2 inches thick. The surface layer is pale brown stony loam about 11 inches thick. The subsoil is brown very gravelly clay about 25 inches thick. Bedrock is at a depth of 36 inches. A few stones are on the surface in most places.

Permeability of the Dubakella soil is slow. Available water capacity is very low to low. Effective rooting depth is 20 to 40 inches. Runoff is medium to rapid, and the hazard of water erosion is moderate to high.

This unit is used for wildlife habitat and watershed.

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

214—Rock outcrop-Louie complex, 0 to 15 percent slopes. This map unit is on terraces (fig. 2). The native vegetation is mainly mixed oak and juniper woodland with associated shrubs and grasses. Elevation is 2,500 to 3,500 feet. The average annual precipitation is about 13 inches, the average annual air temperature is about 50 degrees F, and the average frost-free period is about 125 days.

This unit is 45 percent Rock outcrop and 35 percent Louie stony loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Delaney sandy loam that has slopes of 0 to 5 percent, Medford clay

loam, soils that are covered with stones and boulders, and a soil that is similar to the Louie soil but has slopes of more than 15 percent. Included areas make up about 20 percent of the total acreage.

Rock outcrop consists of exposures of bedrock. It does not support vegetation.

The Louie soil is moderately deep to a hardpan and is well drained. It formed in alluvium derived dominantly from extrusive igneous rock. Typically, the surface layer is light brownish gray stony loam about 6 inches thick. The next layer is light brownish gray cobbly loam about 6 inches thick. The upper 9 inches of the subsoil is yellowish brown cobbly loam. The lower 8 inches is yellowish brown cobbly sandy clay loam. The next layer is a light yellowish brown, strongly cemented hardpan about 3 inches thick. The underlying material to a depth of 60 inches or more is stratified sand, gravel, cobbles, and some stones. A few stones are on the surface in most places.

Permeability of the Louie soil is moderately slow above the impervious hardpan and rapid below it. Available water capacity is very low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used as rangeland.

This unit is poorly suited to use as rangeland. The production of vegetation suitable for livestock grazing is limited by the many areas of Rock outcrop. Management practices suitable for use on the unit are proper range use and deferred grazing. Trails can be constructed in places to encourage livestock grazing in areas where access is limited.

The potential plant community on the Louie soil includes Idaho fescue, bluebunch wheatgrass, beardless wheatgrass, and buckbrush.

This map unit is in capability subclass VIIIs(21), nonirrigated.

215—Rock outcrop-Terwilliger complex, 2 to 50 percent slopes. This map unit is on hills. The native vegetation is mainly perennial grasses, forbs, and shrubs. Elevation is 2,200 to 3,500 feet. The average annual precipitation is about 18 inches, the average annual air temperature is about 50 degrees F, and the average frost-free period is about 125 days.

This unit is 40 percent Rock outcrop and 30 percent Terwilliger stony silty clay loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of a soil that is similar to this Terwilliger soil but is underlain by bedrock at a depth of 10 to 20 inches, Hilt stony sandy loam, Mary stony loam, and a soil that is similar to this Terwilliger soil but has slopes of more than 50 percent. Included areas make up about 30 percent of the total acreage.



Figure 2—Area of Rock outcrop-Louie complex, 0 to 15 percent slopes. This soil provides important habitat for upland wildlife and waterfowl.

Rock outcrop consists of exposures of bedrock. It does not support vegetation.

The Terwilliger soil is moderately deep and well drained. It formed in residuum derived dominantly from siltstone. Typically, the surface layer is light brownish gray stony silty clay loam about 6 inches thick. The upper 13 inches of the subsoil is pale brown and light olive brown silty clay loam. The lower 15 inches is light yellowish brown silty clay and olive gravelly silty clay. Weathered rock is at a depth of 34 inches. A few stones are on the surface in most places.

Permeability of the Terwilliger soil is slow. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used as rangeland.

This unit is poorly suited to use as rangeland. The production of vegetation suitable for livestock grazing is limited by the many areas of Rock outcrop and slope.

Rock outcrop and steepness of slope limit access by livestock and promote overgrazing of the less sloping areas. Trails or walkways can be constructed in places to encourage livestock grazing in areas where access is limited.

The potential plant community on the Terwilliger soil includes Idaho fescue, Oregon white oak, rabbitbrush, and western juniper.

This map unit is in capability subclass VII_s(21), nonirrigated.

216—Rock outcrop. This map unit consists of exposures of limestone and igneous bedrock. Large areas of limestone Rock outcrop are northwest of Gazelle, and areas of igneous Rock outcrop are throughout the survey area. Slope is 9 to 50 percent. Drainage is excessive, and runoff is very rapid. Because of the very rapid runoff from the rock, the hazard of erosion on the small areas of included soils is very high.

Included in this unit are small areas of shallow and very shallow soils that vary in texture, Mary loam, Jilson gravelly loam, Terwilliger loam, sedimentary rock, serpentine, and soils that have slopes of 50 to 80 percent. Included areas make up about 15 percent of the mapped acreage.

This unit is used for wildlife habitat and watershed. A few areas are also used for quarrying limestone.

This map unit is in capability subclass VIIIs(5,21,22), nonirrigated.

217—Salisbury clay loam, 0 to 2 percent slopes.

This well drained soil is on terraces. It is moderately deep to a hardpan. The soil formed in alluvium derived from mixed rock sources. The vegetation in areas not cultivated is mainly perennial grasses, forbs, and shrubs. Elevation is 2,500 to 4,500 feet. The average annual precipitation is about 13 inches, the average annual air temperature is about 48 degrees F, and the average frost-free period is about 125 days.

Typically, the surface layer is gray clay loam about 4 inches thick. The upper 4 inches of the subsoil is dark grayish brown clay loam. The lower 16 inches is dark grayish brown and dark brown clay. The next layer is a strongly cemented hardpan about 8 inches thick. Below this to a depth of 60 inches or more is stratified sand, gravel, and some stones.

Included in this unit are small areas of a Kuck clay loam, Lassen clay, and Mary loam that have slopes of 0 to 2 percent. Also included are a few areas of Medford clay loam. Included areas make up about 15 percent of the total acreage.

Permeability of this Salisbury soil is slow above the impervious hardpan and rapid below it. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for cultivated crops, hay and pasture, rangeland, and homesite development.

This unit is suited to irrigated and nonirrigated wheat and barley. It is limited mainly by depth to hardpan. The hardpan can be ripped and shattered. This increases the effective rooting depth and improves internal drainage.

Furrow, border, corrugation, and sprinkler irrigation systems are suited to this unit. The method used generally is governed by the crop grown. In areas where the hardpan has not been ripped, irrigation water must be applied carefully to prevent the development of a perched water table. Drainage may also be required.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth.

This unit is suited to hay and pasture. It has few limitations. Proper grazing practices, weed control, and fertilizer are needed for maximum quality of forage. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Irrigation

water can be applied by the sprinkler and border methods.

This unit is suited to use as rangeland. It has few limitations. The soil in the unit responds well to fertilizer, to range seeding, and to proper grazing use. Grazing should be delayed until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.

The potential plant community on this unit includes bottlebrush squirreltail, Idaho fescue, bluebunch wheatgrass, and sagebrush.

If this unit is used for homesite development, the main limitations are the depth to the hardpan, low load supporting capacity, the potential for shrinking and swelling, and slow permeability. Mulching, fertilizing, and irrigating are needed to establish lawn grasses and other small seeded plants.

If buildings are constructed on the soil in this unit, properly designing foundations and footings and diverting runoff away from buildings help to prevent structural damage as a result of shrinking and swelling. Buildings and roads should be designed to offset the limited ability of the soil to support a load.

The suitability of the soil for septic tank absorption fields can be improved by ripping the hardpan to increase permeability. The limitation of slow permeability can also be overcome by increasing the size of the absorption field.

This map unit is in capability unit IIIs-3(21), irrigated and nonirrigated.

218—Salisbury clay loam, 2 to 9 percent slopes.

This well drained soil is on terraces. It is moderately deep to a hardpan. The soil formed in alluvium derived from mixed rock sources. The vegetation in areas not cultivated is mainly perennial grasses, forbs, and shrubs. Elevation is 2,500 to 4,500 feet. The average annual precipitation is about 13 inches, the average annual air temperature is about 48 degrees F, and the average frost-free period is about 125 days.

Typically, the surface layer is gray clay loam about 4 inches thick. The upper 4 inches of the subsoil is dark grayish brown clay loam. The lower 16 inches is dark grayish brown and dark brown clay. The next layer is a strongly cemented hardpan about 8 inches thick. Below this to a depth of 60 inches or more is stratified sand, gravel, cobbles, and some stones.

Included in this unit are small areas of Kuck clay loam, Lassen clay, Mary loam, and Medford clay loam. Included areas make up about 15 percent of the total acreage.

Permeability of this Salisbury soil is slow above the impervious hardpan and rapid below it. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for cultivated crops, hay and pasture, rangeland, and homesite development.

This unit is suited to irrigated and nonirrigated wheat and barley. It is limited mainly by the depth to the hardpan. The hardpan can be ripped and shattered. This increases the effective rooting depth and improves internal drainage.

Furrow, border, corrugation, and sprinkler irrigation systems are suited to this unit. The method used generally is governed by the crop grown. In areas where the hardpan has not been ripped, irrigation water must be applied carefully to prevent the development of a perched water table. Drainage may also be required.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Diversions and grassed waterways may be needed. All tillage should be on the contour or across the slope.

This unit is suited to hay and pasture. It has few limitations. Proper grazing practices, weed control, and fertilizer are needed for maximum quality of forage. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Irrigation water can be applied by the border and sprinkler methods.

This unit is suited to use as rangeland. It has few limitations. The soil in the unit responds well to fertilizer, to range seeding, and to proper grazing use. Grazing should be delayed until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.

The potential plant community on this unit includes bottlebrush squirreltail, Idaho fescue, bluebunch wheatgrass, and sagebrush.

If this unit is used for homesite development, the main limitations are depth to rock, low load supporting capacity, the potential for shrinking and swelling, and slow permeability. Erosion is a hazard in the steeper areas. Only the part of the site that is used for construction should be disturbed. Mulching, fertilizing, and irrigating are needed to establish lawn grasses and other small seeded plants.

If buildings are constructed on the soil in this unit, properly designing foundations and footings and diverting runoff away from buildings help to prevent structural damage as a result of shrinking and swelling. Buildings and roads should be designed to offset the limited ability of the soil to support a load.

The suitability of the soil for septic tank absorption fields can be improved by ripping the hardpan to increase permeability. The limitation of slow permeability can also be overcome by increasing the size of the absorption field.

This map unit is in capability unit IIIe-3(21), irrigated and nonirrigated.

219—Salisbury gravelly clay loam, 0 to 5 percent slopes. This well drained soil is on terraces. It is moderately deep to a hardpan. The soil formed in alluvium derived from mixed rock sources. The

vegetation in areas not cultivated is mainly perennial grasses, forbs, and shrubs. Elevation is 2,500 to 4,500 feet. The average annual precipitation is about 13 inches, the average annual air temperature is about 48 degrees F, and the average frost-free period is about 125 days.

Typically, the surface layer is gray gravelly clay loam about 4 inches thick. The upper 4 inches of the subsoil is dark grayish brown gravelly clay loam. The lower 16 inches is dark grayish brown and dark brown gravelly clay. The next layer is a strongly cemented hardpan about 8 inches thick. Below this to a depth of 60 inches or more is stratified sand, gravel, cobbles, and some stones.

Included in this unit are small areas of a Kuck clay loam that has slopes of 0 to 9 percent, a Lassen clay that has slopes of 0 to 9 percent, Mary loam, and Medford clay loam. Included areas make up about 15 percent of the total acreage.

Permeability of this Salisbury soil is slow above the impervious hardpan and rapid below it. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for cultivated crops, hay and pasture, rangeland, and homesite development.

This unit is suited to irrigated and nonirrigated wheat and barley. It is limited mainly by the depth to the hardpan and gravel in the surface layer. The hardpan can be ripped and shattered. This increases the effective rooting depth and improves internal drainage.

Furrow, border, corrugation, and sprinkler irrigation systems are suited to this unit. The method used generally is governed by the crop grown. In areas where the hardpan has not been ripped, irrigation water must be applied carefully to prevent the development of a perched water table. Drainage may also be required.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Gravel in the surface layer causes rapid wear of equipment used for tillage.

This unit is suited to hay and pasture. It has few limitations. Proper grazing practices, weed control, and fertilizer are needed for maximum quality of forage. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Irrigation water can be applied by the border and sprinkler methods.

This unit is suited to use as rangeland. It has few limitations. The soil in this unit responds well to fertilizer, to range seeding, and to proper grazing use. Grazing should be delayed until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.

The potential plant community on this unit includes bluebunch wheatgrass, Douglas rabbitbrush, sagebrush, and Idaho fescue.

If this unit is used for homesite development, the main limitations are the depth to rock, low load supporting capacity, the potential for shrinking and swelling, gravel in the surface layer, and slow permeability. Removal of pebbles in disturbed areas is required for best results when landscaping, particularly in areas used for lawns. Mulching, fertilizing, and irrigating are needed to establish lawn grasses and other small seeded plants.

If buildings are constructed on the soil in this unit, properly designing foundations and footings and diverting runoff away from buildings help to prevent structural damage as a result of shrinking and swelling. Buildings and roads should be designed to offset the limited ability of the soil to support a load.

The suitability of the soil for septic tank absorption fields can be improved by ripping the hardpan to increase permeability. The limitation of slow permeability can also be overcome by increasing the size of the absorption field.

This map unit is in capability unit IIIe-3(21), irrigated and nonirrigated.

220—Salisbury gravelly clay loam, 5 to 9 percent slopes. This well drained soil is on terraces. It is moderately deep to a hardpan. The soil formed in alluvium derived from mixed rock sources. The vegetation in areas not cultivated is mainly perennial grasses, forbs, and shrubs. Elevation is 2,500 to 4,500 feet. The average annual precipitation is about 13 inches, the average annual air temperature is about 48 degrees F, and the average frost-free period is about 125 days.

Typically, the surface layer is gray gravelly clay loam about 4 inches thick. The upper 4 inches of the subsoil is dark grayish brown gravelly clay loam. The lower 16 inches is dark grayish brown and dark brown gravelly clay. The next layer is a strongly cemented hardpan about 8 inches thick. Below this to a depth of 60 inches or more is stratified sand, gravel, cobbles, and some stones.

Included in this unit are small areas of Kuck clay loam, Lassen clay, Mary loam, and Medford clay loam. Included areas make up about 15 percent of the total acreage.

Permeability of this Salisbury soil is slow above the impervious hardpan and rapid below it. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for cultivated crops, hay and pasture, rangeland, and homesite development.

This unit is suited to irrigated and nonirrigated wheat and barley. It is limited mainly by the depth to the hardpan and gravel in the surface layer. The hardpan can be ripped and shattered. This increases the effective rooting depth and improves internal drainage.

Furrow, border, corrugation, and sprinkler irrigation systems are suited to this unit. Irrigation water should be applied at a rate that insures optimum production without increasing runoff, deep percolation, and erosion. In areas where the hardpan has not been ripped, irrigation water must be applied carefully to prevent the development of a perched water table. Drainage may also be required.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Diversions and grassed waterways may be needed. All tillage should be on the contour or across the slope. Gravel in the surface layer causes rapid wear of equipment used for tillage.

This unit is suited to hay and pasture. It has few limitations. Proper grazing practices, weed control, and fertilizer are needed for maximum quality of forage. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Irrigation water can be applied by the border and sprinkler methods.

This unit is suited to use as rangeland. It has few limitations. The soil in this unit responds well to fertilizer, to range seeding, and to proper grazing use. Grazing should be delayed until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.

The potential plant community on this unit includes bluebunch wheatgrass, Douglas rabbitbrush, sagebrush, and Idaho fescue.

If this unit is used for homesite development, the main limitations are depth to rock, low load supporting capacity, the potential for shrinking and swelling, slow permeability, and gravel in the surface layer. Erosion is a hazard in the steeper areas. Only the part of the site that is used for construction should be disturbed.

Removal of pebbles and cobbles in disturbed areas is required for best results when landscaping, particularly in areas used for lawns. Mulching, fertilizing, and irrigating are needed to establish lawn grasses and other small seeded plants.

If buildings are constructed on the soil in this unit, properly designing foundations and footings and diverting runoff away from buildings help to prevent structural damage as a result of shrinking and swelling. Buildings and roads should be designed to offset the limited ability of the soil to support a load.

The suitability of the soil for septic tank absorption fields can be improved by ripping the hardpan to increase permeability. The limitation of slow permeability can also be overcome by increasing the size of the absorption field.

This map unit is in capability unit IIIe-3(21), irrigated and nonirrigated.

221—Salisbury cobbly loam, 0 to 9 percent slopes. This well drained soil is on terraces. It is moderately deep to a hardpan. The soil formed in alluvium derived

from mixed rock sources. The vegetation in areas not cultivated is mainly perennial grasses, forbs, and shrubs. Elevation is 2,500 to 4,500 feet. The average annual precipitation is about 13 inches, the average annual air temperature is about 48 degrees F, and the average frost-free period is about 125 days.

Typically, the surface layer is gray cobbly loam about 4 inches thick. The upper 4 inches of the subsoil is dark grayish brown gravelly clay loam. The lower 16 inches is dark grayish brown and dark brown gravelly clay. The next layer is a strongly cemented hardpan about 8 inches thick. Below this to a depth of 60 inches or more is stratified sand, gravel, cobbles, and some stones. A few cobbles are on the surface in most places.

Included in this unit are small areas of Kuck clay loam, Lassen cobbly clay, a Mary loam that has slopes of 2 to 9 percent, Medford clay loam, and soils that have slopes of as much as 15 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Salisbury soil is slow above the impervious hardpan and rapid below it. Available water capacity is very low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is slow to medium, and the hazard of water erosion is slight to moderate.

This unit is used as rangeland and for homesite development.

This unit is suited to use as rangeland. The production of vegetation suitable for livestock grazing is limited by cobbles on the surface. The soil in the unit responds well to fertilizer, to range seeding, and to proper grazing use. Use of mechanical treatment practices is not practical because of the cobbly surface and steepness of slope.

The potential plant community on this unit includes Idaho fescue, western juniper, bluebunch wheatgrass, and sagebrush.

If this unit is used for homesite development, the main limitations are the depth to the hardpan, low load supporting capacity, the potential for shrinking and swelling, slow permeability, and cobbles on the surface. Erosion is a hazard in the steeper areas. Only the part of the site that is used for construction should be disturbed.

Removal of pebbles and cobbles in disturbed areas is required for best results when landscaping, particularly in areas used for lawns. Mulching, fertilizing, and irrigating are needed to establish lawn grasses and other small seeded plants.

If buildings are constructed on the soil in this unit, properly designing foundations and footings and diverting runoff away from buildings help to prevent structural damage as a result of shrinking and swelling. Buildings and roads should be designed to offset the limited ability of the soil to support a load.

The suitability of the soil for septic tank absorption fields can be improved by ripping the hardpan to increase permeability. Use of sandy backfill for the

trench and long absorption lines helps to compensate for the slow permeability.

This map unit is in capability unit IVe-7(21), irrigated and nonirrigated.

222—Settlemeier loam, 0 to 2 percent slopes. This very deep soil is on flood plains. It formed in alluvium derived from mixed rock sources. The vegetation in areas not cultivated is mainly perennial grasses, sedges, and other water-tolerant plants. Elevation is 2,000 to 4,000 feet. The average annual precipitation is about 15 inches, the average annual air temperature is about 50 degrees F, and the average frost-free period is about 125 days.

Typically, the surface layer is gray loam about 10 inches thick. The next layer is gray fine sandy loam, loam, and silt loam about 34 inches thick. Below this to a depth of 66 inches is a buried surface layer of gray silt loam and sandy clay loam.

Included in this unit are small areas of Esro silt loam, Diyoo loam, Stoner gravelly sandy loam, and Riverwash. Also included are areas, in Scott Valley, where precipitation is as much as 18 inches. Included areas make up about 15 percent of the total acreage.

Permeability of this Settlemeier soil is moderately slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. A seasonal high water table is at the surface from December through June but fluctuates between depths of 12 and 24 inches the rest of the year. This soil is subject to flooding about 3 years out of 10 during prolonged, high-intensity storms. Channeling and deposition are common along streambanks.

This unit is used as rangeland.

This unit is suited to use as rangeland. The production of vegetation suitable for livestock grazing is limited by the high water table and the hazard of flooding. The soil in this unit responds well to fertilizer, to range seeding, and to proper grazing use. Plants that tolerate wetness should be seeded. Grazing should be delayed until the soil has drained sufficiently and is firm enough to withstand trampling by livestock. If the plant cover is disturbed, protection from flooding is needed to control gullying, streambank cutting, and sheet erosion.

The potential plant community on this unit includes carex, rush, tufted hairgrass, bluegrass, and redtop.

This map unit is in capability unit VIw-2(21), irrigated and nonirrigated.

223—Settlemeier loam, drained, 2 to 5 percent slopes. This very deep, poorly drained soil is on flood plains. It formed in alluvium derived from mixed rock sources. The vegetation in areas not cultivated is mainly perennial grasses, sedges, and other water-tolerant plants. Elevation is 2,000 to 4,000 feet. The average annual precipitation is about 15 inches, the average

annual air temperature is about 50 degrees F, and the average frost-free period is about 125 days.

Typically, the surface layer is gray loam about 10 inches thick. The next layer is gray fine sandy loam, loam, and silt loam about 34 inches thick. Below this to a depth of 66 inches is a buried surface layer of gray silt loam and sandy clay loam.

Included in this unit are small areas of Esro silt loam, Diyoo loam, Stoner gravelly sandy loam, and Riverwash. Also included are small areas of a soil that is similar to this Settlemeier soil but is in an area where the average annual precipitation is as much as 20 inches. Included areas make up about 15 percent of the total acreage.

Permeability of this Settlemeier soil is moderately slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. A seasonal high water table is at a depth of 0 to 24 inches from February through June. The rest of the year it is at a depth of 24 to 36 inches. This soil is subject to flooding during prolonged, high-intensity storms. About 1 year out of 10, channeling and deposition are common along streambanks.

This unit is used for hay and pasture and as rangeland.

This unit is suited to dryland hay and pasture. The main limitation is the seasonal high water table. Proper grazing practices, weed control, and fertilizer are needed for maximum quality of forage. Wetness limits the choice of plants and the period of cutting or grazing and increases the risk of winterkill. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff.

This unit is suited to use as rangeland. The production of vegetation suitable for livestock grazing is limited by the seasonal high water table. The soil in this unit responds well to fertilizer, to range seeding, and to proper grazing use. Plants that tolerate wetness should be seeded. Grazing should be delayed until the soil has drained sufficiently and is firm enough to withstand trampling by livestock. If the plant cover is disturbed, protection from flooding is needed to control gullying, streambank cutting, and sheet erosion.

The potential plant community on this unit includes carex, rush, tufted hairgrass, and bluegrass.

This map unit is in capability unit IIIw-2(21), irrigated and nonirrigated.

224—Settlemeier Variant silt loam. This very deep, poorly drained soil is on alluvial fans. It formed in alluvium derived from mixed rock sources. Slope is 0 to 2 percent. The native vegetation is mainly perennial grasses, sedges, and other water-tolerant plants. Elevation is 2,000 to 3,000 feet. The average annual precipitation is about 18 inches, the average annual air temperature is about 50 degrees F, and the average frost-free period is about 125 days.

Typically, the surface layer is very dark gray and dark gray silt loam about 19 inches thick. The subsoil is dark gray, light olive gray, and olive gray silty clay loam about 49 inches thick. It is mottled with black, olive brown, light olive brown, olive gray, and olive. The substratum to a depth of 80 inches is greenish gray gravelly clay loam.

Included in this unit are small areas of a soil that is similar to this Settlemeier Variant soil but is covered by sandy loam overwash 5 to 15 inches thick. Also included are small areas of soils that have slopes of as much as 9 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Settlemeier Variant soil is slow. Available water capacity is high to very high. Effective rooting depth is 60 inches or more. Runoff is very slow. A seasonal high water table is at a depth of 0 to 18 inches from December through April. The rest of the year the water table is at a depth of 18 to 36 inches. About 2 years in 10, this soil is subject to flooding for brief periods from December through March.

This unit is used for hay and pasture and as rangeland.

This unit is suited to irrigated hay and pasture. The main limitation is the high water table. Grasses and legumes that require good drainage can be grown if a deep tile drainage system is installed. Proper grazing practices, weed control, and fertilizer are needed for maximum quality of forage. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff.

Sprinkler irrigation is the most suitable method of applying water. Irrigation water must be applied carefully to prevent the development of a perched water table.

This unit is suited to use as rangeland. The production of vegetation suitable for livestock grazing is limited by the high water table. The soil in this unit responds well to fertilizer, to range seeding, and to proper grazing use. Plants that tolerate wetness should be seeded. Grazing should be delayed until the soil is firm and the more desirable forage plants have achieved sufficient growth to withstand grazing pressure.

Management practices suitable for use on this unit are proper range use, deferred grazing, rotation grazing, and aerial spraying for brush management.

The potential plant community on this unit includes carex, rush, tufted hairgrass, and bluegrass.

This map unit is in capability unit IIIw-2(21), irrigated and nonirrigated.

225—Sheld very stony sandy loam, 50 to 65 percent slopes. This deep, well drained soil is on mountains. It formed in volcanic ash overlain by residuum derived dominantly from extrusive igneous rock. The native vegetation is mainly mixed conifers. Elevation is 4,500 to 7,500 feet. The average annual precipitation is about 40 inches, the average annual air

temperature is about 41 degrees F, and the average frost-free period is about 50 days.

Typically, the surface is covered with a mat of undecomposed and partially decomposed needles, leaves, twigs, bark, and other organic debris about 2 inches thick. The surface layer is dark brown and brown very stony sandy loam about 7 inches thick. The next layer is brown gravelly sandy loam about 12 inches thick. The subsoil is brown and reddish gray very gravelly sandy loam and reddish gray and weak red very gravelly loam about 27 inches thick. Weathered rock is at a depth of 46 inches. Many stones are on the surface in most places.

Included in this unit are small areas of a soil that is similar to this Sheld soil but is underlain by bedrock at a depth of 20 to 40 inches, an Iller soil that has slopes of more than 50 percent, soils that are covered with stones and boulders, and Rock outcrop. Included areas make up about 15 percent of the total acreage.

Permeability of this Sheld soil is moderate. Available water capacity is low to moderate. Effective rooting depth is 40 to 60 inches. Runoff is very rapid, and the hazard of water erosion is very high.

This unit is used as woodland.

This unit is suited to the production of ponderosa pine, Douglas-fir, and white fir. It can produce about 2,613 cubic feet, or 11,680 board feet (Scribner rule), of timber per acre from a fully stocked stand of even-aged ponderosa pine trees 80 years old.

The main concerns in producing and harvesting timber are the hazard of erosion, stoniness, equipment limitations, seedling mortality, and plant competition. Management that minimizes the risk of erosion is essential in harvesting timber. Proper design of road drainage systems and care in the placement of culverts help to control erosion. Spoil from excavations is subject to rill and gully erosion and to sloughing.

The steepness of slope limits the kinds of equipment that can be used in forest management. The high-lead logging method is more efficient than most other methods and is less damaging to the soil surface. Stones on the surface can interfere with felling, yarding, and other operations involving the use of equipment.

If site preparation is not adequate, competition from undesirable plants can prevent or prolong natural or artificial reestablishment of trees. Proper site preparation controls initial plant competition, and spraying controls subsequent growth. The low to moderate available water capacity generally influences seedling survival in areas where understory plants are numerous. Among the trees that are suitable for planting is white fir.

The understory includes bottlebrush squirreltail, snowbrush ceanothus, and California brome.

This map unit is in capability subclass VIIs(22), nonirrigated.

226—Sheld-Iller stony sandy loams, 9 to 30

percent slopes. This map unit is on mountains. The native vegetation is mainly mixed conifers. Elevation is 4,500 to 7,500 feet. The average annual precipitation is about 40 inches, the average annual air temperature is about 41 degrees F, and the average frost-free period is about 50 days.

This unit is 40 percent Sheld stony sandy loam and 25 percent Iller stony sandy loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of a soil that is similar to this Sheld soil but is underlain by bedrock at a depth of 20 to 40 inches, Rock outcrop, and soils that have slopes of as much as 50 percent. Included areas make up about 30 percent of the total acreage.

The Sheld soil is deep and well drained. It formed in volcanic ash deposited over residuum derived dominantly from extrusive igneous rock. Typically, the surface is covered with a mat of undecomposed and partially decomposed needles, leaves, twigs, bark, and other organic debris about 2 inches thick. The surface layer is dark brown and brown stony sandy loam 7 inches thick. The next layer is brown gravelly sandy loam about 12 inches thick. The subsoil is brown and reddish gray very gravelly sandy loam and reddish gray and weak red very gravelly loam about 27 inches thick. Weathered rock is at a depth of 46 inches. A few stones are on the surface in most places.

Permeability of this Sheld soil is moderate. Available water capacity is low to moderate. Effective rooting depth is 40 to 60 inches. Runoff is medium to rapid, and the hazard of water erosion is moderate to high.

The Iller soil is very deep and well drained. It formed in volcanic ash deposited over residuum derived dominantly from extrusive igneous rock. Typically, the surface is covered with a mat of undecomposed and partially decomposed needles, leaves, twigs, bark, and other organic debris about 1 inch thick. The surface layer is dark brown and brown stony sandy loam about 13 inches thick. The subsoil is brown sandy loam about 15 inches thick. The next layer is a buried subsoil of yellowish brown very stony sandy loam and brown extremely stony loam about 37 inches thick. A few stones are on the surface in most places.

Permeability of this Iller soil is moderate. Available water capacity is low or moderate. Effective rooting depth is 60 inches or more. Runoff is medium or rapid, and the hazard of water erosion is moderate to high.

This unit is used as woodland.

This unit is suited to the production of white fir, California red fir, and ponderosa pine. The Sheld soil can produce about 2,613 cubic feet, or 11,680 board feet (Scribner rule), of timber per acre. The Iller soil can produce about 4,396 cubic feet, or 20,000 board feet, per acre. Production is estimated for a fully stocked stand of even-aged ponderosa pine trees 80 years old.

The main concerns in producing and harvesting timber are seedling mortality and plant competition. If site preparation is not adequate, competition from undesirable plants can prevent or prolong natural or artificial reestablishment of trees. Proper site preparation controls initial plant competition, and spraying controls subsequent growth. The low available water capacity generally influences seedling survival in areas where understory plants are numerous. White fir is suitable for planting on this unit. In addition, California red fir and ponderosa pine are suitable on the Iller soil.

The understory on the Sheld soil includes bottlebrush squirreltail and snowbrush ceanothus. The understory on the Iller soil includes sierra chinquapin, California brome, and snowberry.

This map unit is in capability subclass Vle(22), nonirrigated.

227—Sheld-Iller stony sandy loams, 30 to 50 percent slopes. This map unit is on mountains. The native vegetation is mainly mixed conifers. Elevation is 4,500 to 7,500 feet. The average annual precipitation is about 40 inches, the average annual air temperature is about 41 degrees F, and the average frost-free period is about 50 days.

This unit is 45 percent Sheld stony sandy loam and 20 percent Iller stony sandy loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are about 15 percent soils that are similar to this Sheld soil but are underlain by bedrock at a depth of 20 to 40 inches, 10 percent Rock outcrop, and 10 percent Snell very stony loam that has slopes of 5 to 30 percent, soils that are covered with stones and boulders, and soils that have slopes of as much as 75 percent. Included areas make up about 35 percent of the total acreage.

The Sheld soil is deep and well drained. It formed in volcanic ash deposited over residuum derived dominantly from extrusive igneous rock. Typically, the surface is covered with a mat of undecomposed and partially decomposed needles, leaves, twigs, bark, and other organic debris about 2 inches thick. The surface layer is dark brown and brown stony sandy loam 7 inches thick. The next layer is brown gravelly sandy loam about 12 inches thick. The subsoil is brown and reddish gray very gravelly sandy loam and reddish gray and weak red very gravelly loam about 27 inches thick. Weathered rock is at a depth of 46 inches. A few stones are on the surface in most places.

Permeability of the Sheld soil is moderate. Available water capacity is low to moderate. Effective rooting depth is 40 to 60 inches. Runoff is rapid, and the hazard of water erosion is high.

The Iller soil is very deep and well drained. It formed in volcanic ash deposited over residuum derived dominantly from extrusive igneous rock. Typically, the surface is

covered with a mat of undecomposed and partially decomposed needles, leaves, twigs, bark, and other organic debris about 1 inch thick. The surface layer is dark brown and brown stony sandy loam about 13 inches thick. The subsoil is brown sandy loam about 15 inches thick. Below this is a buried subsoil of yellowish brown very stony sandy loam and brown extremely stony sandy clay loam about 37 inches thick. A few stones are on the surface in most places.

Permeability of the Iller soil is moderate. Available water capacity is low to moderate. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

This unit is used as woodland.

This unit is suited to the production of white fir, California red fir, and ponderosa pine. The Sheld soil can produce about 2,613 cubic feet, or 11,680 board feet (Scribner rule), of timber per acre. The Iller soil can produce about 4,396 cubic feet, or 20,000 board feet, per acre. Production is estimated for a fully stocked stand of even-aged ponderosa pine trees 80 years old.

The main concerns in producing and harvesting timber are the hazard of erosion, equipment limitations, seedling mortality, and plant competition. The steepness of slope limits the kinds of equipment that can be used in forest management.

If site preparation is not adequate, competition from undesirable plants can prevent or prolong natural or artificial reestablishment of trees. Proper site preparation controls initial plant competition, and spraying controls subsequent growth. The low available water capacity generally influences seedling survival in areas where understory plants are numerous. White fir is suitable for planting on this unit. In addition, California red fir and ponderosa pine are suitable on the Iller soil.

The understory on the Sheld soil includes bottlebrush squirreltail and snowbrush ceanothus. The understory on the Iller soil includes sierra chinquapin, California brome, and snowberry.

This map unit is in capability subclass Vle(22), nonirrigated.

228—Snell very stony loam, 5 to 30 percent slopes. This moderately deep, well drained soil is on mountains. It formed in residuum derived dominantly from extrusive igneous rock. The native vegetation is mainly mixed oak and juniper woodland with associated shrubs, grasses, and forbs. Elevation is 4,800 to 6,500 feet. The average annual precipitation is about 40 inches, the average annual air temperature is about 41 degrees F, and the average frost-free period is about 50 days.

Typically, the surface layer is grayish brown very stony loam about 4 inches thick. The subsoil is brown very cobbly clay loam and very cobbly clay about 17 inches thick. Bedrock is at a depth of 21 inches. Many stones are on the surface in most places.

Included in this unit are small areas of a soil that is similar to this Snell soil but has a stony loam subsoil, soils that are covered with stones and boulders, Rock outcrop, and soils that have slopes of more than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Snell soil is moderately slow. Available water capacity is very low to low. Effective rooting depth is 20 to 40 inches. Runoff is medium to rapid, and the hazard of water erosion is moderate to high.

This unit is used as rangeland.

This unit is suited to use as rangeland. The production of vegetation suitable for livestock grazing is limited by stones on the surface. Use of mechanical treatment practices is not practical because of the stony surface. Management practices suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. Grazing should be delayed until the soil is firm and the more desirable forage plants have achieved sufficient growth to withstand grazing pressure.

The potential plant community on this unit includes Idaho fescue, western juniper, antelope bitterbrush, and mountainmahogany.

This map unit is in capability subclass VIIs(22), nonirrigated.

229—Stoner gravelly sandy loam, 0 to 2 percent slopes. This very deep, well drained soil is on alluvial fans. It formed in alluvium derived from mixed rock sources. The vegetation in areas not cultivated is mainly perennial grasses, forbs, and shrubs. Elevation is 2,000 to 4,000 feet. The average annual precipitation is about 18 inches, the average annual air temperature is about 50 degrees F, and the average frost-free period is about 125 days.

Typically, the surface layer is brown gravelly sandy loam about 12 inches thick. The upper 24 inches of the subsoil is brown and light yellowish brown gravelly sandy loam. The lower 24 inches is strong brown very gravelly loam.

Included in this unit are small areas of Bonnet gravelly loam, Dotta gravelly loam, Diyoo loam, soils that are highly stratified with layers of various textures, and Riverwash. Included areas make up about 15 percent of the total acreage.

Permeability of this Stoner soil is moderate. Available water capacity is low or moderate. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for cultivated crops, hay and pasture, rangeland, and homesite development.

This unit is suited to irrigated and nonirrigated wheat and barley (fig. 3). It is limited mainly by the gravelly surface layer. Gravel in the surface layer causes rapid wear of equipment used for tillage.

In summer, irrigation is required for maximum production of most crops. Furrow, border, corrugation,

and sprinkler irrigation systems are suited to this unit. The method used generally is governed by the crop grown. Leveling is needed in sloping areas for the efficient application and removal of irrigation water. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crop needs.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth.

This unit is suited to hay and pasture. It has few limitations. Proper grazing practices, weed control, and fertilizer are needed for maximum quality of forage. Irrigation water can be applied by the border and sprinkler methods.

This unit is suited to use as rangeland. It has few limitations. The soil in this unit responds well to fertilizer, to range seeding, and to proper grazing use.

The potential plant community on this unit includes bottlebrush squirreltail, bluebunch wheatgrass, Idaho fescue, and buckbrush.

This unit is suited to homesite development. It has few limitations. Mulching, fertilizing, and irrigating are needed to establish lawn grasses and other small seeded plants.

This map unit is in capability unit IIIs-4(21), irrigated and nonirrigated.

230—Stoner gravelly sandy loam, 2 to 5 percent slopes. This very deep, well drained soil is on alluvial fans. It formed in alluvium derived from mixed rock sources. The vegetation in areas not cultivated is mainly perennial grasses, forbs, and shrubs. Elevation is 2,000 to 4,000 feet. The average annual precipitation is about 18 inches, the average annual air temperature is about 50 degrees F, and the average frost-free period is about 125 days.

Typically, the surface layer is brown gravelly sandy loam about 12 inches thick. The upper 24 inches of the subsoil is brown and light yellowish brown gravelly sandy loam. The lower 24 inches is strong brown very gravelly loam.

Included in this unit are small areas of Bonnet gravelly loam, Dotta gravelly loam, Riverwash, and a Stoner gravelly sandy loam that has slopes of 5 to 15 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Stoner soil is moderate. Available water capacity is low to moderate. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for cultivated crops, hay and pasture, rangeland, and homesite development.

This unit is suited to irrigated and nonirrigated wheat and barley. It is limited mainly by the hazard of erosion

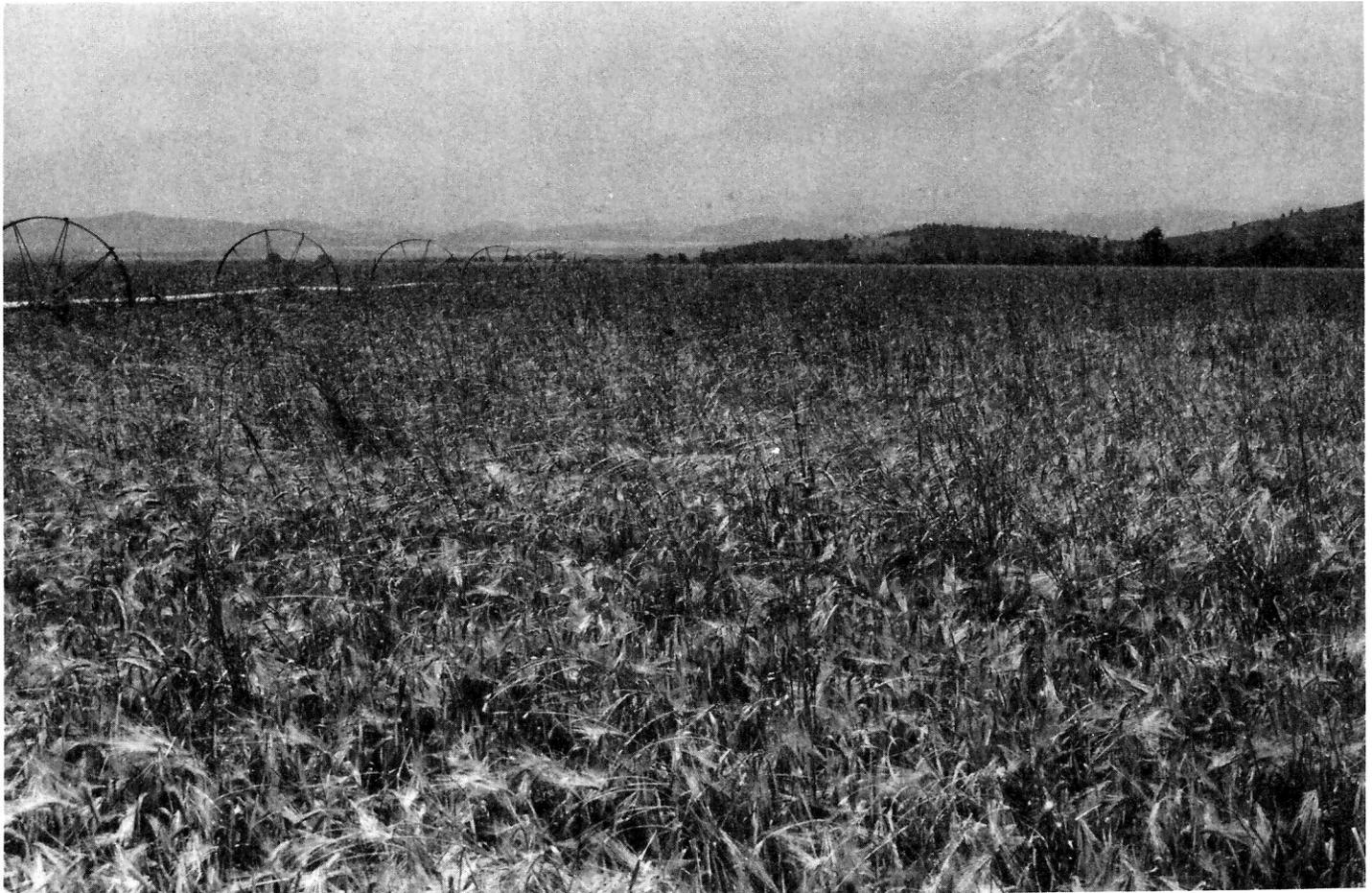


Figure 3.—Irrigated barley on Stoner gravelly sandy loam, 0 to 2 percent slopes. Mt. Shasta is in the background.

and the gravelly surface layer. Gravel in the surface layer causes rapid wear of equipment used for tillage.

In summer, irrigation is required for maximum production of most crops. Furrow, border, corrugation, and sprinkler irrigation systems are suited to the unit. The method used generally is governed by the crop grown. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crop needs.

Tilling on the contour or across the slope reduces erosion. Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth.

This unit is suited to hay and pasture. It has few limitations. Proper grazing practices, weed control, and fertilizer are needed for maximum quality of forage. Irrigation water can be applied by the border and sprinkler methods.

This unit is suited to use as rangeland. It has few limitations. The soil in this unit responds well to fertilizer, to range seeding, and to proper grazing use.

The potential plant community on this unit includes bottlebrush squirreltail, bluebunch wheatgrass, Idaho fescue, and buckbrush.

This unit is suited to homesite development. It has few limitations. Mulching, fertilizing, and irrigating help to establish lawn grasses and other small seeded plants. Preserving the existing plant cover during construction helps to control erosion.

This map unit is in capability unit IIIe-4(21), irrigated and nonirrigated.

231—Stoner gravelly sandy loam, 5 to 15 percent slopes. This very deep, well drained soil is on alluvial fans. It formed in alluvium derived from mixed rock sources. The vegetation in areas not cultivated is mainly

perennial grasses, forbs, and shrubs. Elevation is 2,000 to 4,000 feet. The average annual precipitation is about 18 inches, the average annual air temperature is about 50 degrees F, and the average frost-free period is about 125 days.

Typically, the surface layer is brown gravelly sandy loam about 12 inches thick. The upper 24 inches of the subsoil is brown and light yellowish brown gravelly sandy loam. The lower 24 inches is strong brown very gravelly loam.

Included in this unit are small areas of Bonnet gravelly loam, a Dotta gravelly loam that has slopes of 2 to 5 percent, Riverwash, and a soil that is similar to this Stoner gravelly sandy loam but has slopes of more than 15 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Stoner soil is moderate. Available water capacity is low to moderate. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for cultivated crops, hay and pasture, rangeland, and homesite development.

This unit is suited to irrigated and nonirrigated wheat and barley. It is limited mainly by slope, the hazard of erosion, and the gravelly surface layer. Gravel in the surface layer causes rapid wear of equipment used for tillage.

In summer, irrigation is required for maximum production of most crops. Sprinkler irrigation is suited to this unit. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crop needs.

Tilling on the contour or across the slope reduces erosion. Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth.

This unit is suited to hay and pasture. The main limitation is slope. Proper grazing practices, weed control, and fertilizer are needed for maximum quality of forage. Because of slope, irrigation water can best be applied by sprinklers.

This unit is suited to use as rangeland. It has few limitations. The soil in this unit responds well to fertilizer, to range seeding, and to proper grazing use.

The potential plant community on this unit includes bottlebrush squirreltail, bluebunch wheatgrass, Idaho fescue, and buckbrush.

This unit is suited to homesite development. The main limitations are slope and the hazard of erosion. The steepness of slope is a concern in installing septic tank absorption fields. Absorption lines should be installed on the contour.

Mulching, fertilizing, and irrigating help to establish lawn grasses and other small seeded plants. Preserving the existing plant cover during construction helps to control erosion, which is a hazard in the steeper areas.

Only the part of the site that is used for construction should be disturbed.

This map unit is in capability unit IIIe-4(21), irrigated and nonirrigated.

232—Terwilliger silty clay loam, 2 to 9 percent slopes. This moderately deep, well drained soil is on hills. It formed in residuum derived dominantly from siltstone. The vegetation in areas not cultivated is mainly perennial grasses, forbs, and shrubs. Elevation is 2,200 to 3,500 feet. The average annual precipitation is about 18 inches, the average annual air temperature is about 50 degrees F, and the average frost-free period is about 125 days.

Typically, the surface layer is light brownish gray silty clay loam about 6 inches thick. The upper 13 inches of the subsoil is pale brown and light olive brown silty clay loam. The lower 15 inches is light yellowish brown silty clay and olive gravelly silty clay. Weathered rock is at a depth of 34 inches. In some areas the surface layer is silt loam.

Included in this unit are small areas of Hilt sandy loam, Mary loam, Salisbury clay loam, Medford clay loam, and Rock outcrop. Included areas make up about 15 percent of the total acreage.

Permeability of this Terwilliger soil is slow. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is slow to medium, and the hazard of water erosion is slight to moderate.

This unit is used for cultivated crops, hay and pasture, rangeland, and homesite development.

This unit is suited to irrigated and nonirrigated wheat and barley. It is limited mainly by the hazard of erosion and slow permeability.

In summer, irrigation is required for maximum production of most crops. Contour ditch and sprinkler irrigation systems are suited to the unit. The method used generally is governed by the crop grown. Because of the slow permeability of the soil in this unit, water should be applied at a slow rate over a long period to insure that the root zone is properly wetted.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Tilling on the contour or across the slope reduces erosion.

This unit is suited to hay and pasture. The main limitation is slope. Proper grazing practices, weed control, and fertilizer are needed for maximum quality of forage. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Because of slope, irrigation water can best be applied by the contour ditch and sprinkler methods.

This unit is suited to use as rangeland. It has few limitations. The soil in the unit responds well to fertilizer, to range seeding, and to proper grazing use. Grazing

should be delayed until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.

The potential plant community on this unit includes Idaho fescue, bluebunch wheatgrass, beardless wheatgrass, and buckbrush.

This unit is suited to homesite development. The main limitations are slope, depth to rock, slow permeability, low load supporting capacity, and the potential for shrinking and swelling. The deep cuts needed to provide essentially level building sites can expose bedrock.

Preserving the existing plant cover during construction helps to control erosion. Mulching, fertilizing, and irrigating are needed to establish lawn grasses and other small seeded plants.

If buildings are constructed on the soil in this unit, properly designing foundations and footings and diverting runoff away from buildings help to prevent structural damage as a result of shrinking and swelling. Buildings and roads should be designed to offset the limited ability of the soil to support a load.

Slow permeability and limited depth to bedrock increase the possibility of failure of septic tank absorption fields. Because of this, onsite investigation is required to determine the proper design for a waste disposal system.

This map unit is in capability unit IIIe-5(21), nonirrigated.

223—Terwilliger silty clay loam, 9 to 15 percent slopes. This moderately deep, well drained soil is on hills. It formed in residuum derived dominantly from siltstone. The vegetation in areas not cultivated is mainly perennial grasses, forbs, and shrubs. Elevation is 2,200 to 3,500 feet. The average annual precipitation is about 18 inches, the average annual air temperature is about 50 degrees F, and the average frost-free period is about 125 days.

Typically, the surface layer is light brownish gray silty clay loam about 6 inches thick. The upper 13 inches of the subsoil is pale brown and light olive brown silty clay loam. The lower 15 inches is light yellowish brown silty clay and olive gravelly silty clay. Weathered rock is at a depth of 34 inches. In some areas the surface layer is silt loam.

Included in this unit are small areas of Hilt sandy loam, Mary loam, a Salisbury clay loam that has slopes of 2 to 9 percent, Medford clay loam, Rock outcrop, and a Terwilliger silty clay loam that has slopes of as much as 50 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Terwilliger soil is slow. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for cultivated crops, hay and pasture, rangeland, and homesite development.

This unit is suited to irrigated and nonirrigated wheat and barley. It is limited mainly by slope and the hazard of erosion.

In summer, irrigation is required for maximum production of most crops. Because of slope, contour ditch and sprinkler irrigation systems are best suited to this unit. The method used generally is governed by the crop grown. Because of the slow permeability of the soil in this unit, water should be applied at a slow rate over a long period to insure that the root zone is properly wetted.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Tilling on the contour or across the slope reduces erosion.

This unit is suited to hay and pasture. The main limitation is slope. Proper grazing practices, weed control, and fertilizer are needed for maximum quality of forage. Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Because of slope, irrigation water should be applied by the contour ditch or sprinkler method.

This unit is suited to use as rangeland. It has few limitations. The soil in this unit responds well to fertilizer, to range seeding, and to proper grazing use. Grazing should be delayed until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.

The potential plant community on this unit includes Idaho fescue, bluebunch wheatgrass, beardless wheatgrass, and buckbrush.

This unit is suited to homesite development. The main limitations are slope, depth to rock, slow permeability, low load supporting capacity, and the potential for shrinking and swelling. The deep cuts needed to provide essentially level building sites can expose bedrock.

Preserving the existing plant cover during construction helps to control erosion. Mulching, fertilizing, and irrigating are needed to establish lawn grasses and other small seeded plants.

If buildings are constructed on the soil in this unit, properly designing foundations and footings and diverting runoff away from buildings help to prevent structural damage as a result of shrinking and swelling. Buildings and roads should be designed to offset the limited ability of the soil to support a load.

Slow permeability and limited depth to bedrock increase the possibility of failure of septic tank absorption fields. Because of this, onsite investigation is required to determine the proper design for a waste disposal system.

This map unit is in capability unit IIIe-5(21), irrigated and nonirrigated.

234—Terwilliger silty clay loam, 15 to 50 percent slopes. This moderately deep, well drained soil is on hills. It formed in residuum derived dominantly from

siltstone. The native vegetation is mainly perennial grasses, forbs, and shrubs. Elevation is 2,200 to 3,500 feet. The average annual precipitation is about 18 inches, the average annual air temperature is about 50 degrees F, and the average frost-free period is about 125 days.

Typically, the surface layer is light brownish gray silty clay loam about 6 inches thick. The upper 13 inches of the subsoil is pale brown and light olive brown silty clay loam. The lower 15 inches is light yellowish brown silty clay and olive gravelly silty clay. Weathered rock is at a depth of 34 inches. In some areas the surface layer is silt loam.

Included in this unit are small areas of Hilt sandy loam, Mary loam, a Medford clay loam that has slopes of as little as 5 percent, Rock outcrop, and a soil that is similar to this Terwilliger soil but has slopes of more than 50 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Terwilliger soil is slow. Available water capacity is low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used as rangeland.

This unit is suited to use as rangeland. The production of vegetation suitable for livestock grazing is limited by slope. Steepness of slope limits access by livestock and promotes overgrazing of the less sloping areas.

The soil in this unit responds well to fertilizer, to range seeding, and to proper grazing use. Grazing should be delayed until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.

The potential plant community on this unit includes Idaho fescue, bluebunch wheatgrass, beardless wheatgrass, and buckbrush.

This map unit is in capability subclass Vle(21), nonirrigated.

235—Terwilliger stony silty clay loam, 2 to 50 percent slopes. This moderately deep, well drained soil is on hills. It formed in residuum derived dominantly from siltstone. The native vegetation is mainly perennial grasses, forbs, and shrubs. Elevation is 2,200 to 3,500 feet. The average annual precipitation is about 18 inches, the average annual air temperature is about 50 degrees F, and the average frost-free period is about 125 days.

Typically, the surface layer is light brownish gray stony silty clay loam about 6 inches thick. The upper 13 inches of the subsoil is pale brown and light olive brown silty clay loam. The lower 15 inches is light yellowish brown silty clay and olive gravelly silty clay. Weathered rock is at a depth of 34 inches. A few stones are on the surface in most places. In some areas the surface layer is stony silt loam.

Included in this unit are small areas of Mary stony loam, Medford clay loam, Rock outcrop, and a soil that is

similar to this Terwilliger soil but has slopes of more than 50 percent. Included areas make up about 20 percent of the total acreage.

Permeability of this Terwilliger soil is slow. Available water capacity is very low to moderate. Effective rooting depth is 20 to 40 inches. Runoff is medium to rapid, and the hazard of water erosion is moderate to high.

This unit is used as rangeland.

This unit is suited to use as rangeland. The production of vegetation suitable for livestock grazing is limited by slope and stones on the surface. Steepness of slope limits access by livestock and promotes overgrazing of the less sloping areas. Use of mechanical treatment practices is not practical because of the stony surface and steepness of slope.

The soil in this unit responds well to fertilizer, to range seeding, and to proper grazing use. Grazing should be delayed until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.

The potential plant community on this unit includes Idaho fescue, white oak, rabbitbrush, big sagebrush, and western juniper.

This map unit is in capability subclass Vle(21), nonirrigated.

236—Uhlig Variant stony loam, 5 to 50 percent slopes. This deep, well drained soil is on terrace escarpments. It formed in alluvium derived dominantly from extrusive igneous rock. The native vegetation is mainly perennial grasses, shrubs, and forbs. Elevation is 2,500 to 4,000 feet. The average annual precipitation is about 13 inches, the average annual air temperature is about 50 degrees F, and the average frost-free period is about 125 days.

Typically, the surface is covered with a mat of undecomposed and partially decomposed needles, leaves, twigs, bark, and other organic debris about 1 inch thick. The surface layer is dark grayish brown stony loam about 14 inches thick. The subsoil is pale brown stony loam about 28 inches thick. Soft rock is at a depth of 42 inches. A few stones are on the surface in most places.

Included in this unit are small areas of a Delaney sandy loam that has slopes of 2 to 5 percent, Redola loam, and a soil that is similar to this Uhlig soil but is more than 60 inches deep to soft rock. Included areas make up about 25 percent of the total acreage.

Permeability of this Uhlig Variant soil is moderate. Available water capacity is very low to moderate. Effective rooting depth is 40 to 60 inches. Runoff is medium to rapid, and the hazard of water erosion is moderate to high.

This unit is used as rangeland.

This unit is suited to use as rangeland. The production of vegetation suitable for livestock grazing is limited by slope and stones on the surface. Use of mechanical treatment practices is not practical because of

steepness of slope and the stony surface. Steepness of slope limits access by livestock and promotes overgrazing of the less sloping areas.

Management practices suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. Grazing should be delayed until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.

The potential plant community on this unit includes bottlebrush squirreltail, Idaho fescue, bluebunch wheatgrass, and western juniper.

This map unit is in capability subclass VIe(21), nonirrigated.

237—Weitchpec Variant-Rock outcrop complex, 5 to 65 percent slopes.

This map unit is on mountains. The native vegetation is mainly brush and juniper. Elevation is 2,500 to 5,000 feet. The average annual precipitation is about 35 inches, the average annual air temperature is about 48 degrees F, and the average frost-free period is about 125 days.

This unit is 40 percent Weitchpec gravelly loam and 30 percent Rock outcrop. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of a Dubakella stony loam that has slopes of 30 to 50 percent and a soil that is similar to this Weitchpec Variant soil but is underlain by bedrock at a depth of 20 to 40 inches. Included areas make up about 30 percent of the total acreage.

The Weitchpec Variant soil is shallow and well drained. It formed in residuum derived dominantly from serpentine. Typically, the surface layer is grayish brown gravelly loam about 4 inches thick. The upper 4 inches of the subsoil is grayish brown gravelly clay loam. The lower 8 inches is grayish brown very gravelly clay loam. Bedrock is at a depth of 16 inches.

Permeability of this Weitchpec Variant soil is moderately slow. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is medium to very rapid, and the hazard of water erosion is moderate to very high.

Rock outcrop consists of exposed areas of bedrock. It supports no vegetation.

This unit is used as rangeland.

This unit is poorly suited to use as rangeland. The production of vegetation suitable for livestock grazing is limited by slope, the areas of Rock outcrop, and shallow soil depth. Use of mechanical treatment practices is not practical because of the many areas of Rock outcrop and steepness of slope. Steepness of slope and the areas of Rock outcrop also limit access by livestock and promote overgrazing of the less sloping areas. Trails or walkways can be constructed in places to encourage livestock grazing in areas where access is limited.

Management practices suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. Grazing should be delayed until the soil in the unit is firm and the more desirable forage plants have achieved sufficient growth to withstand grazing pressure.

The potential plant community on this unit includes manzanita, western juniper, and buckbrush.

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

238—Xerofluvents, nearly level. This map unit consists of soils on flood plains of major streams throughout the survey area. It is flooded about 2 years in 4. The vegetation is mainly willows, cottonwood, blackberry, and sparse stands of grass. The mean annual precipitation is 17 to 50 inches, and the mean annual air temperature is 48 to 52 degrees F. The average frost-free season is about 100 days.

The soils in this unit are multicolored, stratified sand, loamy sand, gravelly sandy loam, and gravel. Drainage is excessive, and the hazards of erosion and deposition are very high. Permeability is variable. Effective rooting depth is 36 to 60 inches. Available water capacity is very low. Surface runoff is slow.

Included in this unit are about 15 percent Riverwash and 10 percent Deetz stony loamy sand, Diyou loam, Rock outcrop, and Rubble land.

This unit is used as watershed and for wildlife habitat.

This map unit is in capability subclass VIIw, dryland.

use and management of the soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavior characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as rangeland and woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

crops and pasture

By Edward S. Anderson, soil conservationist, and Larry A. Day, conservation agronomist, Soil Conservation Service.

The main management practices applicable to the soils in the survey area that are suited to crops and pasture are those that help to maintain or improve production and that minimize erosion. Among these practices are conservation cropping systems, crop residue management, proper tillage, irrigation water management, erosion control, excess water removal,

pasture management, summer fallow, and subsoiling. These practices are briefly discussed in the following paragraphs.

Conservation cropping systems are systems for growing crops in combination with needed cultural and management practices. If soil improving crops and practices used in the system more than offset the soil depleting crops and deteriorating practices, then it is a good conservation cropping system. Cropping systems are needed on all tilled soils in the survey area.

Soil improving practices in a conservation cropping system include the use of rotations that contain grasses and legumes, the return of crop residue to the soil, the use of green manure crops of grasses and legumes, proper tillage, adequate fertilization, and weed and pest control.

Crop residue management consists of returning crop residue to the soil. Residue returned to the soil helps to maintain soil structure, organic matter content, and fertility, and it helps to control erosion. On sloping soils, residue should be left on the soil surface during periods when the risk of erosion is greatest.

Proper tillage consists of using the minimum number of operations necessary to control weeds, incorporate crop residue, obtain favorable air and water movement in the soil, and prepare an adequate seedbed. Tillage breaks down soil structure, reduces the organic matter content of the soil, and can create a plowpan below the depth of tillage. Loss of soil structure and organic matter increases the hazard of soil erosion, and the plowpan limits permeability and restricts root penetration. Varying the depth of tillage retards the development of a plowpan, and infrequent shallow chiseling helps to break up the pan. Combining tillage operations to reduce the number of trips over a field and delaying tillage while soils are wet are other important ways of maintaining soil tilth and minimizing compaction.

Irrigation water management is achieved by controlling the rate, amount, and timing of applications of irrigation water. It is designed to use the available irrigation water to supply the moisture needed by crops while minimizing soil erosion and plant nutrient loss. Also, it reduces water loss and protects water quality.

Irrigation methods used in the soil survey area are furrow, border, corrugation, sprinkler, and contour ditch systems. Furrow, border, and corrugation irrigation should be limited to slopes of 4 percent or less. Contour ditch irrigation should be used on slopes of more than 4

percent. Sprinkler irrigation is suited to all tillable soils of the area. Irrigation water should be applied at a rate and in amounts adequate for crop needs and soil characteristics without excess runoff or deep percolation. To help conserve water, irrigation canals should be lined and irrigation pipelines should be used where possible.

Erosion control generally is needed on sloping soils and on all soils subject to soil blowing. Erosion can be recognized by the accumulation of soil material at the base of slopes, in drainageways, and along fence lines, or it is evidenced by rills and gullies on side slopes.

Many practices are used to control erosion. Land leveling or smoothing, selection of the best method of irrigation, and control of irrigation water help to control erosion on irrigated soils. Crop residue use, proper tillage, and cross-slope farming are some of the management practices used to control erosion.

Structural measures, used either individually or in combination, also may be needed to control erosion. Streambanks can be stabilized by installing rock riprap or by planting vegetation to stabilize the soils, or by both. Gullies can be shaped and planted to grass.

Excess water removal is needed to remove excess water that accumulates either as a result of rainfall or irrigation. Excess water may be a problem in low-lying areas, in swales, or at the lower end of irrigated fields. It results in decreased crop production. Using tailwater return systems allows waste water to be reused.

Excess water may be controlled by shaping and grading, land leveling, constructing open drainage ditches, and properly managing irrigation water.

Pasture management is needed for irrigated and nonirrigated pastures to prevent soil deterioration, provide for maximum production, maintain a desirable plant community, and extend the life of the pasture.

Kuck, Lassen, Montague, and Bonnet soils are suitable for nonirrigated pastures that are planted to grasses and legumes in alternate rows. Fertilizer should be banded 2 inches deep and 2 inches to the side of the seed. During the year of establishment, grazing should not be permitted and annual weeds should be mowed.

After pasture is established, grazing should not start until the plants are about 6 to 10 inches high and livestock should be removed when plants are 3 to 6 inches high. Every fourth year each pasture should be allowed to head out before grazing.

In irrigated pastures, legumes should make up no more than 20 percent of the planting mix. The pasture should be seeded in a firm seedbed early in spring. The new pasture should not be grazed until the plants are well established and are at least 8 inches high. The plants should not be grazed closer than 4 inches. Rotation grazing using a minimum of three fields is a suitable practice. This enables the fields to dry out after irrigation, reduces compaction, and allows for regrowth of the plants.

Nitrogen and phosphorus are required on pastures.

Summer fallow is a way of keeping the land free of vegetation during one crop season and storing moisture

for crop production the following season. It also helps to control weeds, plant diseases, and insects. Under a summer fallow system of farming, crop production tends to be more stable and complete crop failures during years of low rainfall are less frequent.

Subsoiling is a method of shattering the hardpan in a soil by means of a ripping attachment mounted on a tractor. Subsoiling enhances permeability and internal drainage, helps to prevent development of a perched water table, allows deeper root penetration, and may increase available water capacity.

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Soil Conservation Service and the Storie index used by the University of California are explained; and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed soil map units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

yields per acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 5. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green-manure crops; and harvesting that insures the smallest possible loss.

For yields of irrigated crops, it is assumed that the irrigation system is adapted to the soils and to the crops grown, that good quality irrigation water is uniformly applied as needed, and that tillage is kept to a minimum.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 5 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or the Cooperative Extension Service can provide information about the management and productivity of the soils.

land capability classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor does it consider possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for woodland, and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit. These levels are defined in the following paragraphs.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have slight limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly

corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w*, *s*, or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation.

Capability units are soil groups within a subclass. The soils in a capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe-4 or IIIe-6. The numbers used to designate units within the subclasses are as follows:

0.—Indicates that a problem or limitation is caused by stony, cobbly, or gravelly material in the substratum.

1.—Indicates that a problem or limitation is caused by slope or by actual or potential erosion hazard.

2.—Indicates that a problem or limitation of wetness is caused by poor drainage or flooding.

3.—Indicates that a problem or limitation of slow or very slow permeability of the subsoil or substratum is caused by a clayey subsoil or a substratum that is semiconsolidated.

4.—Indicates that a problem or limitation is caused by sandy or gravelly soils with a low available water capacity.

5.—Indicates that a problem or limitation is caused by a fine textured or very fine textured surface layer.

6.—Indicates that a problem or limitation is caused by salt or alkali.

7.—Indicates that a problem or limitation is caused by rocks, stones, or cobbles.

8.—Indicates that a problem or limitation exists in the root zone, which generally is less than 40 inches thick over massive bedrock and lacks moisture for plants.

9.—Indicates that a problem or limitation is caused by low or very low fertility, acidity, or toxicity that cannot be corrected by adding normal amounts of fertilizer, lime, or other amendments.

No unit designations are shown for class I soils, because soil characteristics are similar for all soils in this class. Unit designations also are not shown for class V through VIII soils, because these soils are not intensively managed as cropland.

Capability groupings are identified in the description of each soil map unit in the section "Detailed soil map units."

land resource areas

In this survey area, capability classification is further refined by designating land resource areas in which the

soils in a unit occur. A land resource area is a broad geographic area that has a distinct combination of climate, soils, vegetation, management needs, and cropping systems. Parts of three of these nationally designated areas are in this survey area. These areas are designated as 5, 21, and 22. Land resource area 5 is made up of the Siskiyou-Trinity area, area 21 is made up of Klamath and Shasta Valleys and Basins, and area 22 is made up of the Sierra Nevada Range.

Land resource area 5.—This area includes about 41 percent of the survey area. It consists of hills and mountains. The soils are gently sloping to very steep. Elevation ranges from 2,000 to 6,000 feet. Average annual rainfall ranges from 20 to 30 inches. The soils are used as woodland and rangeland.

Land resource area 21.—This area includes about 44 percent of the survey area. It consists of valley floors and adjacent terraces of the Shasta and Scott Rivers. The soils are nearly level to very steep. Elevation ranges from 2,000 to 4,500 feet. Average annual rainfall ranges from 13 to 18 inches. The soils are used as rangeland, for hay, and for irrigated and nonirrigated wheat, barley, and pasture.

Land resource area 22.—This area includes about 15 percent of the survey area. It consists of hills and mountains. The soils are gently sloping to very steep. Elevation ranges from 2,700 to 7,500 feet. Average annual rainfall ranges from 30 to 40 inches. The soils are used as woodland and rangeland and for dryfarmed grain.

Land resource areas are given in parentheses as part of the capability classification following the description of each soil map unit in the section "Detailed soil map units."

storie index rating

By Gordon L. Huntington, lecturer and soil specialist, Department of Land, Air, and Water Resources, University of California, Davis.

In table 6, the soils in the survey area are rated according to the Storie index (7, 8, 9). This index expresses numerically the relative degree of suitability of a soil for general intensive agricultural use as it exists at the time of evaluation. The rating is based on soil characteristics only and is obtained by evaluating factors such as depth, surface soil texture, subsoil characteristics, drainage, salts and alkali, and relief. Other factors, such as availability of water for irrigation, climate, and distance to markets, that might determine the desirability of growing certain plants in a given locality are not considered. Therefore, in itself, the index should not be used as a direct indicator of land value. However, where economic factors are known to the user, the Storie index provides additional objective information for land tract value comparisons.

Four general factors are used in determining the index rating: (A) the permeability of the soil profile and soil depth; (B) the texture of the surface soil; (C) the

dominant slope of the soil body; and (X) other factors more readily subject to management or modification. In this survey area the X factors include drainage, erosion, microrelief, nutrient level, salts and sodium, and soil acidity. For some soils more than one of the X factors are used in rating. Each of the four general factors is evaluated on the basis of 100 percent. A rating of 100 percent expresses the most favorable or ideal condition for general crop production. Lower percentage ratings are selected from data and observations that relate soil properties to plant growth and crop yield (7). In the tables currently used (8, 9), certain soil properties are allowed ranges of values to conform with variations of the properties in relation to their effect on the suitability of the soil for general agricultural purposes; for example, soil depth or proportion of gravel present in a gravelly loam surface soil. The modal condition of a soil property, as it is described in a soil map unit, is used to select a value for rating when a range of tabular values exists.

The index rating for a soil is obtained by multiplying the rating values given to its four factors, A, B, C, and X. If more than one X factor exists for a soil, the values for the additional factor, or factors, act as additional multipliers. Thus, any factor may dominate or control the final rating. For example, consider a soil such as Diyou loam. It is a deep soil with a moderately slowly permeable profile and an effective rooting depth of 60 inches or more. This warrants a rating of 95 for factor A. It has a workable loam surface soil, warranting a rating of 100 for factor B. A smooth, nearly level surface to the soil justifies 100 percent for factor C. However, it is subject to flooding, warranting a value of 80, and has a water table at a depth of 2 to 3 feet, warranting a value of 60. Multiplied together, this produces a rating of 48 for factor X. Multiplying A, B, C, and X gives a Storie index of 46 for Diyou loam. If, in time, the water table can be lowered and the flood hazard decreased, the Storie index can be increased by assigning appropriate higher values to the X factors to reflect the changed conditions. Diyou loam, drained, with an index value of 72, is an example.

Soil complexes in the survey area, such as Duzel-Jilson-Facey complex, 15 to 50 percent slopes, are rated to reflect the proportion of the dominant soils described in the unit. Each of the dominant soils in such complexes is rated separately and the values shown in table 6. The single index value for each complex is a weighted average. Miscellaneous area map units, such as Dumps, Rock outcrop, or Lava flows, are not evaluated in terms of the factors A, B, C, or X. They have features that are very severely limiting for agricultural use of any kind. As such, they are assigned an index value of less than 10.

Soils are placed in grades according to their suitability for general intensive agriculture as shown by their Storie

index ratings. The six grades and their range in index ratings are:

	<i>Index rating</i>
Grade 1.....	80 to 100
Grade 2.....	60 to 80
Grade 3.....	40 to 60
Grade 4.....	20 to 40
Grade 5.....	10 to 20
Grade 6.....	Less than 10

In this area, soils in *Grade 1* are well suited to intensive use for irrigated crops that are climatically adapted to the region. *Grade 2* soils are good agricultural soils, although they are not so desirable as soils in *Grade 1* because of heavier or coarser surface soil texture, a somewhat less permeable subsoil, a slight hazard of flooding or moderate depth to a water table, gentle to moderate slopes, or slight accumulations of salts and sodium. *Grade 3* soils are only fairly well suited to agriculture and are limited in their use because of moderate to steep slopes, moderate to shallow soil depth, low fertility level, rock outcroppings, clayey surface soil texture, hazard of flooding, poor drainage, or stones and gravel on the surface. *Grade 4* soils are poorly suited. They are severely limited in their agricultural potential because of shallower depth, steeper slopes, more numerous rock outcroppings, more frequent flooding, or poorer drainage than for soils in *Grade 3*. *Grade 5* soils are very poorly suited to agriculture. *Grade 6* consists of soils and miscellaneous areas that are not suited at all because of very severe to extreme limitations with regard to the aforementioned properties, including, in some cases, strong saline or sodic conditions.

rangeland

By Warren E. Peden, range conservationist, Soil Conservation Service

About 44 percent of the survey area is rangeland. Most ranches are cow-calf-steer operations. The average size of the ranches is about 1,000 acres. In summer, many of the ranches have access to grazing lands administered by the Forest Service.

Soils strongly influence the natural vegetation. In the northeastern part of the survey area, most of the soils are clayey and are moderately deep over tuff and basalt. These soils support perennial and annual grasses and forbs, shrubs, and trees. In much of the southwestern part of the survey area, the soils are loams and gravelly loams that are underlain by metamorphic rock. Production on these loamy soils is fair to good depending on depth and exposure. Soils on north-facing slopes commonly are more productive than those on south-facing slopes.

In areas that have similar climate and topography, differences in the kind and amount of vegetation produced on rangeland are closely related to the kind of soil. Effective management is based on the relationship between the soils and vegetation and water.

Table 7 shows, for each soil, the range site; the total annual production of vegetation in favorable, normal, and unfavorable years; the characteristic vegetation; and the average percentage of each species. Only those soils that are used as or are suited to rangeland are listed. Explanation of the column headings in table 7 follows.

A *range site* is a distinctive kind of rangeland that produces a characteristic natural plant community that differs from natural plant communities on other range sites in kind, amount, and proportion of range plants. The relationship between soils and vegetation was established during this survey; thus, range sites generally can be determined directly from the soil map. Soil properties that affect moisture supply and plant nutrients have the greatest influence on the productivity of range plants. Soil reaction, salt content, and a seasonal high water table are also important.

Total production is the amount of vegetation that can be expected to grow annually on well managed rangeland that is supporting the potential natural plant community. It includes all vegetation, whether or not it is palatable to grazing animals. It includes the current year's growth of leaves, twigs, and fruits of woody plants. It does not include the increase in stem diameter of trees and shrubs. It is expressed in pounds per acre of air-dry vegetation for favorable, normal, and unfavorable years. In a favorable year, the amount and distribution of precipitation and the temperatures make growing conditions substantially better than average. In a normal year, growing conditions are about average. In an unfavorable year, growing conditions are well below average, generally because of low available soil moisture.

Dry weight is the total annual yield per acre reduced to a common percent of air-dry moisture.

Characteristic vegetation—the grasses, forbs, and shrubs that make up most of the potential natural plant community on each soil—is listed by common name. Under *composition*, the expected percentage of the total annual production is given for each species making up the characteristic vegetation. The amount that can be used as forage depends on the kinds of grazing animals and on the grazing season.

Range management requires a knowledge of the kinds of soil and of the potential natural plant community. It also requires an evaluation of the present range condition. Range condition is determined by comparing the present plant community with the potential natural plant community on a particular range site. The more closely the existing community resembles the potential community, the better the range condition. Range condition is an ecological rating only. It does not have a specific meaning that pertains to the present plant community in a given use.

The objective in range management is to control grazing so that the plants growing on a site are about the same in kind and amount as the potential natural plant community for that site. Such management

generally results in the optimum production of vegetation, reduction of undesirable brush species, conservation of water, and control of water erosion and soil blowing. Sometimes, however, a range condition somewhat below the potential meets grazing needs, provides wildlife habitat, and protects soil and water resources.

The major concerns for rangeland in the area include, but are not limited to, proper grazing use, fertilization, range seeding, planned grazing systems, and brush management. Technical assistance on planning rangeland management and applying practices that are suited to the soils on a particular ranch can be obtained from local representatives of the Soil Conservation Service and Cooperative Extension Service.

In the paragraphs that follow, the chief management concerns for all soils in the survey area used as rangeland are briefly discussed.

Proper grazing use is grazing at an intensity that maintains enough cover to protect the soil and maintain or improve the quantity and quality of the desirable vegetation. This increases the vigor and reproduction of the key plants and promotes the accumulation of litter and mulch necessary to conserve soil and water. It also increases forage production and helps to maintain the natural beauty.

Plant cover is needed to protect soils from erosion and to maintain good forage production. The key forage producing grasses, grasslike plants, and forbs should not be grazed closer than 50 percent of their annual growth. Important shrubs should not be grazed more than 60 percent of their annual growth.

Fertilization may be necessary to aid in the initial establishment of desirable plants to control erosion or to improve the existing plant cover. Fertilization increases forage production and lengthens the growing period. In areas where rainfall is less than 12 inches, fertilization is not usually desirable. Whenever a range reseeding program is used, fertilization should be considered.

Range seeding is used to establish desirable plants on rangeland, to produce more forage, or to convert land from other uses to rangeland. It improves the natural beauty of rangeland and reduces soil and water loss.

Planned grazing systems are used to achieve more uniform grazing use. Any grazing system should be keyed to high-producing plants that are locally abundant. Grazing systems are flexible methods of alternating rest with grazing.

Brush management is designed to reduce or eliminate competition of woody vegetation to allow understory grasses and forbs to recover, or to make conditions favorable for reseeding. It increases production of forage, which reduces erosion. Brush management may improve the habitat for some species of wildlife. Mechanical, chemical, or biological methods are used to manage brush.

woodland management and productivity

By John W. Bramhall, forester, Soil Conservation Service

The woodland in the survey area provides wood products for sale or for use on farms and ranches. It also protects the watersheds of Scott and Shasta Valleys, provides food and cover for wildlife, and serves as recreation areas for many people.

The timber produced in the area is used for lumber, plywood, and wood chips, which are produced in wood processing plants located throughout the area. Use of the timber as firewood has been increasing in recent years.

The principal forest cover types in the area are (1) ponderosa pine, sugar pine, and fir; (2) Pacific ponderosa pine; and (3) Pacific ponderosa pine and Douglas-fir. The ponderosa pine, sugar pine, and fir forest type is marked by the predominance of ponderosa pine, sugar pine, white fir, Douglas-fir, or incense-cedar occurring either alone or in combination, provided significant amounts of white fir are present when ponderosa pine or Douglas-fir is the dominant species.

The Pacific ponderosa pine forest type has ponderosa pine occurring in pure stands; that is, the stands are 80 percent or more ponderosa pine. White fir is not present in significant amounts; that is, it makes up 20 percent of the stand or less. Sugar pine is mixed with the ponderosa pine, especially on the better sites, and incense-cedar, Douglas-fir, and small amounts of white fir are present in places.

The Pacific ponderosa pine and Douglas-fir forest type is mainly ponderosa pine and Douglas-fir, although neither species makes up as much as 80 percent of the stand. White fir is not present in significant amounts. Incense-cedar, sugar pine, and a wide variety of hardwoods and other conifers are commonly present in small amounts.

About 301,840 acres, or 34 percent of the area, is in forest cover. This acreage is mainly on uplands, although this has not always been the case. Some of the land has been cleared for cultivated crops and grazing. Fire has been a limiting factor in other areas, many of which are now covered with brush. Many timberlands have been harvested three or four times. Most of the small private ownerships have no remaining merchantable timber. It will be many years before the timber on these lands is again ready for harvest.

Volume estimates for the major species of tree in the survey area are given in the detailed soil map units. Volume estimates for Douglas-fir were taken from USDA Technical Bulletin 201; estimates in cubic feet were obtained from table 2, and those in board feet from table 4. Volume estimates for ponderosa pine were taken from USDA Technical Bulletin 630; estimates in cubic feet were obtained from table 15, and those in board feet from table 16.

Table 8 can be used by woodland owners or forest managers in planning the use of soils for wood crops.

Only those soils suitable for wood crops are listed. The table lists the ordination (woodland suitability) symbol for each soil. Soils assigned the same ordination symbol require the same general management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for important trees. The number 1 indicates very high productivity; 2, high; 3, moderately high; 4, moderate; and 5, low. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *x* indicates stoniness or rockiness; *w*, excessive water in or on the soil; *t*, toxic substances in the soil; *d*, restricted root depth; *c*, clay in the upper part of the soil; *s*, sandy texture; *f*, high content of coarse fragments in the soil profile; and *r*, steep slopes. The letter *o* indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: *x*, *w*, *t*, *d*, *c*, *s*, *f*, and *r*.

In table 8, *slight*, *moderate*, and *severe* indicate the degree of the major soil limitations to be considered in management.

Ratings of *equipment limitation* reflect the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. A rating of *slight* indicates that use of equipment is not limited to a particular kind of equipment or time of year; *moderate* indicates a short seasonal limitation or a need for some modification in management or in equipment; and *severe* indicates a seasonal limitation, a need for special equipment or management, or a hazard in the use of equipment.

Seedling mortality ratings indicate the degree to which the soil affects the mortality of tree seedlings. Plant competition is not considered in the ratings. The ratings apply to seedlings from good stock that are properly planted during a period of sufficient rainfall. A rating of *slight* indicates that the expected mortality is less than 25 percent; *moderate*, 25 to 50 percent; and *severe*, more than 50 percent.

Ratings of *windthrow hazard* are based on soil characteristics that affect the development of tree roots and the ability of the soil to hold trees firmly. A rating of *slight* indicates that a few trees may be blown down by normal winds; *moderate*, that some trees will be blown down during periods of excessive soil wetness and strong winds; and *severe*, that many trees are blown down during periods of excessive soil wetness and moderate or strong winds.

Ratings of *plant competition* indicate the degree to which undesirable plants are expected to invade where there are openings in the tree canopy. The invading plants compete with native plants or planted seedlings. A rating of *slight* indicates little or no competition from other plants; *moderate* indicates that plant competition is expected to hinder the development of a fully stocked stand of desirable trees; *severe* indicates that plant competition is expected to prevent the establishment of

a desirable stand unless the site is intensively prepared, weeded, or otherwise managed to control undesirable plants.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index*. This index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Commonly grown trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

Trees to plant are those that are suited to the soils and to commercial wood production.

woodland understory vegetation

Understory vegetation consists of grasses, forbs, shrubs, and other plants. Some woodland, if well managed, can produce enough understory vegetation to support grazing of livestock or wildlife, or both, without damage to the trees.

The quantity and quality of understory vegetation vary with the kind of soil, the age and kind of trees in the canopy, the density of the canopy, and the depth and condition of the litter. The density of the canopy determines the amount of light that understory plants receive.

Table 9 shows, for each soil suitable for woodland use, the potential for producing understory vegetation. The total production of understory vegetation includes the herbaceous plants and the leaves, twigs, and fruit of woody plants up to a height of 4 1/2 feet. It is expressed in pounds per acre of air-dry vegetation in favorable, normal, and unfavorable years. In a favorable year, soil moisture is above average during the optimum part of the growing season; in a normal year, soil moisture is average; and in an unfavorable year, it is below average.

Table 9 also lists the common names of the characteristic vegetation on each soil and the percentage composition, by air-dry weight, of each kind of plant. The table shows the kind and percentage of understory plants expected under a canopy density that is most nearly typical of woodland in which the production of wood crops is highest.

windbreaks and environmental plantings

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops

from wind, hold snow on the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. To insure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

Table 10 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 10 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from local offices of the Soil Conservation Service, the California Department of Forestry, or the Cooperative Extension Service or from a nursery.

recreation

By D. W. Patterson, biologist, Soil Conservation Service

Outdoor recreation opportunities are seasonal in the soil survey area because of the cold, wet weather late in fall, in winter, and early in spring. Summer tourism and recreation are important in the area. More rugged forms of recreation such as deer hunting and fishing for steelhead and salmon, however, are enjoyed during cold weather. Access for fishing is restricted because of the private ownership patterns along major sections of salmon and steelhead fishing waters, such as the Scott and Klamath Rivers. Hunting and fishing opportunities are greater for the general public on public lands.

The survey area is somewhat removed from population centers, and access to the area is by U.S. Interstate 5. Many secondary roads are unpaved.

The soils of the survey area are rated in table 11 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 11, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil

properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 11 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 14 and interpretations for dwellings without basements and for local roads and streets in table 13.

Camp areas require site preparation such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking, horseback riding, and bicycling should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

wildlife habitat

By D. W. Patterson, biologist, Soil Conservation Service.

Fish and wildlife provide opportunities for both recreation and income, and they add to the quality of life in the survey area. Rangeland and wooded areas interspersed with or adjacent to both irrigated and dryfarmed areas provide many habitats suited to a variety of game and nongame wildlife species. Isolated wetlands offer habitat for both migratory and nesting shore birds and waterfowl, including the Great Basin Canada goose and sandhill crane.

Rangelands dominated by a mixture of brush, grasses, and trees are key habitat areas for wintering herds of Rocky Mountain and California mule deer. Further discussion of wildlife species and their habitats, as well as general wildlife habitat management considerations are given for each general soil map unit described in the section "General soil map units."

Numerous streams traverse the survey area. They support trout fisheries as well as streamside vegetation that provides valuable food and cover for wildlife and fish. The Scott River provides fishing for both steelhead trout and salmon. Farm ponds provide fishing for trout and warm-water fish such as largemouth black bass, bluegill, and catfish.

Adapted trees and shrubs can be planted in odd areas along roads, fences, and field borders to provide both food and cover for wildlife. Soils best suited for plantings are medium textured and are at least 4 feet deep. With the exception of wet or moist soils, all shrub and tree plantings should receive adequate irrigation during the first 2 years of establishment. They should also be protected from livestock and competition from weeds. More information on wildlife plants and establishment methods can be obtained from local offices of the Soil Conservation Service and Cooperative Extension Service or from nurseries.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 12, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be

expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, wheatgrass, orchardgrass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are native wheatgrasses, native fescue, native bluegrass, saltgrass, wild mustard, sweetclover, lupine, vetch, and buckwheat.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, the available water capacity, and wetness. Examples of these plants are oak, willow, wild plum, maple, alder, dogwood, and ash. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are Russian-olive, autumn-olive, and crabapple.

Coniferous plants furnish browse, seeds, and cones. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, spruce, fir, cedar, and juniper.

Shrubs are bushy woody plants that produce fruit, buds, twigs, bark, and foliage. Soil properties and features that affect the growth of shrubs are depth of the root zone, available water capacity, salinity, and soil moisture. Examples of shrubs are deerbrush, mountainmahogany, bitterbrush, snowberry, and sagebrush.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland

plants are smartweed, burreed, cattail, saltgrass, reed canarygrass, rushes, sedges, and reeds.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include bobwhite quail, pheasant, meadowlark, field sparrow, cottontail, and red fox.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include deer, bear, dove, band-tailed pigeon, thrushes, woodpeckers, squirrels, gray fox, raccoon, deer, and bear.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, shore birds, muskrat, mink, and beaver.

Habitat for rangeland wildlife consists of areas of shrubs and wild herbaceous plants. Wildlife attracted to rangeland include cottontail, jackrabbit, California mule deer, Rocky Mountain mule deer, sage grouse, meadowlark, kingbirds, and mountain bluebird.

engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

building site development

Table 13 shows the degree and kind of soil limitations that affect shallow excavations, dwellings without basements, small commercial buildings, and local roads and streets. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic supporting capacity.

sanitary facilities

Table 14 shows the degree and the kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 14 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that

soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to effectively filter the effluent. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 14 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 14 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

construction materials

Table 15 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good*, *fair*, or *poor* as a source of roadfill and topsoil. They are rated as a probable or improbable source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this

table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 15, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

water management

Table 16 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas and embankments, dikes, and levees. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable

material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock or to a cemented pan. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of wind or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct

surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of wind erosion, low available water

capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.