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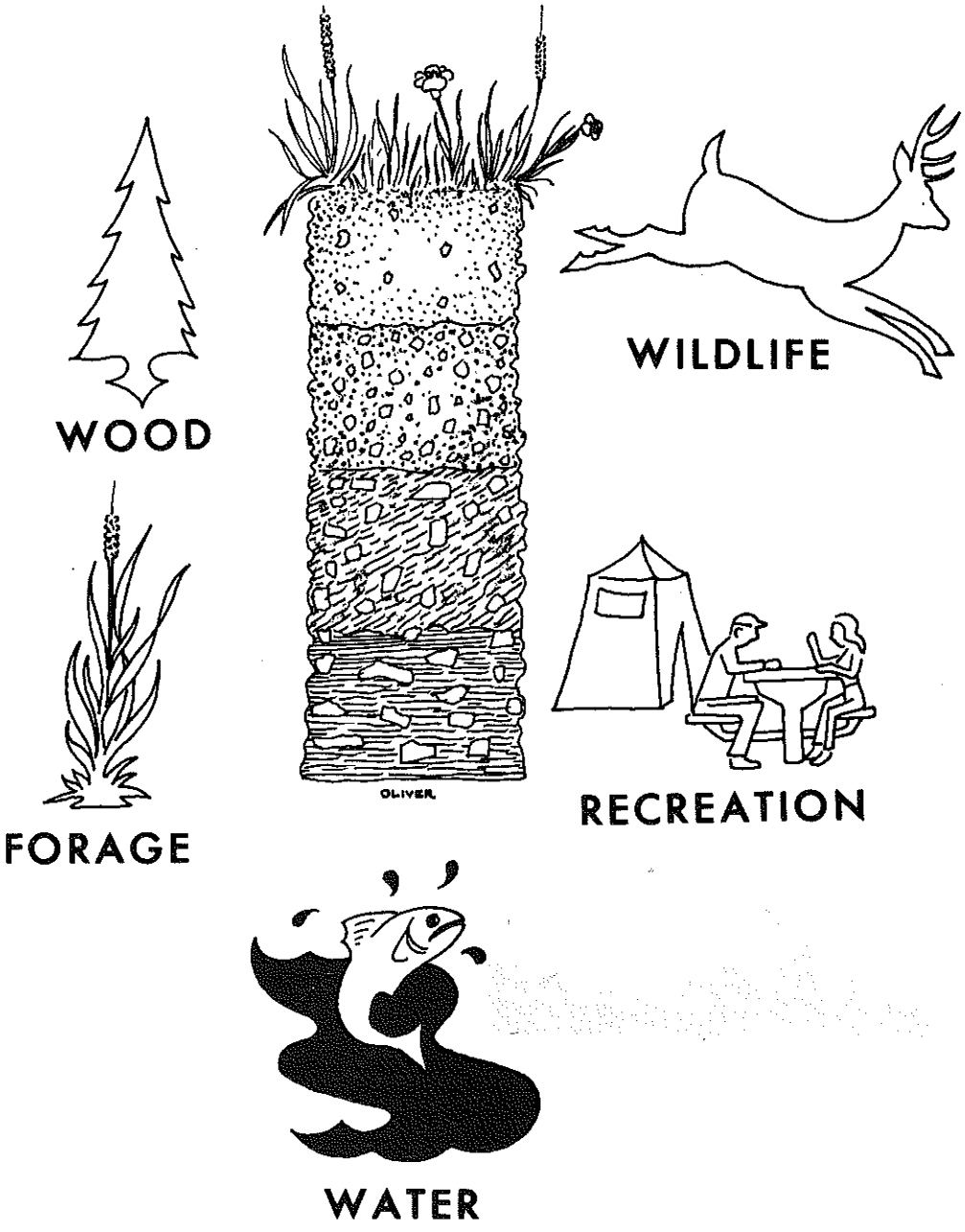
SOIL RESOURCE INVENTORY

WALLOWA-WHITMAN NATIONAL FOREST

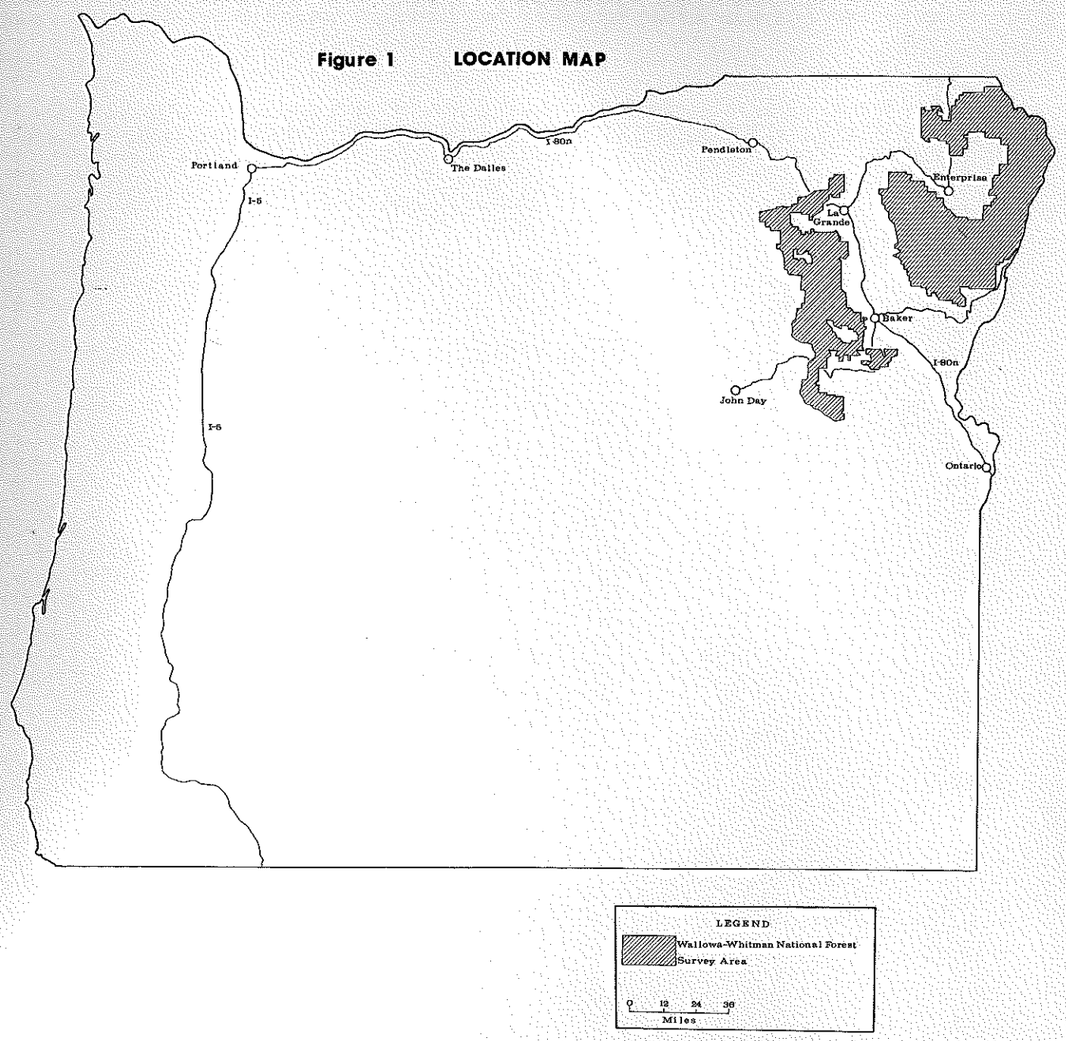
BASIC SOIL INFORMATION
AND
INTERPRETIVE TABLES



FOREST SERVICE

PACIFIC NORTHWEST REGION

Figure 1 LOCATION MAP



This project covers the Wallowa-Whitman National Forest and includes both Forest and other lands within the general Forest boundary. Locally, because of possible land exchange, the boundary was extended as much as 3 miles out from the Forest boundary. The total area mapped is approximately 2.5 million acres. Counties within the mapping area include Baker, Grant, Malheur, Umatilla, Union and Wallowa.

WALLOWA WHITMAN NATIONAL FOREST

SOIL RESOURCE INVENTORY

Pacific Northwest Region

May 16, 1975

Prepared by

John M. Wade

Soil Scientist

PREFACE

This Soil Resource Inventory of the Wallowa-Whitman National Forest was made to provide some basic soil, bedrock and landform information for management interpretations. The inventory is part of the Regional soils program developed by the Soil Management Group of the Division of Watershed Management to assist forest land managers in applying multiple use principles.

The objective of this Soil Resource Inventory is to provide soils information in a form useful to the land manager as an aid to multiple use management as directed by Public Law 86-517. This law states that the National Forests are to be administered to achieve and maintain in perpetuity a high level of annual or regular periodic output of the various renewable resources of the National Forests without impairment of the productivity of the land.

All renewable surface resources of the National Forest are dependent upon soil, which is a nonrenewable resource. Soils develop at a slow rate, about one inch every thousand years in residual soils developing from rock. Soils developing from glacial outwash and till, alluvium, loess, and colluvium proceed at a faster rate. "A" horizons develop much faster and "B" horizons at a somewhat slower rate than residual soils. This fact necessitates conservation, wise use, and in many instances, preservation of this basic resource in order to produce high-level, sustained yields of water, timber, recreation, wildlife, and forage. To accomplish sustained yield of renewable resources, to conserve or preserve the soil resource while making wise use of this resource, it is necessary to have basic soils information and to make sound management interpretations.

This report contains information on climate, soils, geology, landform features, and some management interpretations. An Atlas of soil maps showing location and extent of the various soils, Tables of Management Interpretations, Table of Soil Characteristics of Modal Site, Table of Some Mapping Unit Characteristics, Features and Qualities, and Table of Bedrock Characteristics is an intigral part of this report.

Field mapping was conducted from June 1972 through October 1974 by Soil Scientist John M. Wade.

During the course of the survey, valuable assistance, advice, and cooperation received from Forest personnel was sincerely appreciated.

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USE

Land management activities generally relate to the soil resource. Timber harvest, road construction, recreation development, and many other activities have an effect on the soil resource to some degree. It is extremely important for the land manager to thoroughly understand the effect of the various activities on the soil. It is equally important for the land manager to fully understand the capabilities of the soil resource. Basic soils information contained in this report will help the land managers and planners to (1) determine the effects of management on the soil and water resource, and (2) evaluate the capabilities of the soil for various uses.

A Landtype is the basic unit of soil identification and management interpretation used in the report. It is derived and defined on the basis of its soil, landform, geology, and vegetation characteristics. The range in size delineation is roughly 50 to 600 acres.

At this level, management problems related to the landform and soil are easily defined and interpretations have been made. This information has been tabulated and can be found within the Atlas along with the soil maps.

The Soil Resource Inventory (SRI) has its primary use at the planning level. Soils, landforms, and bedrock characteristics are defined at an intensity sufficient to help develop resource management policies and basic plans. Due to the reconnaissance nature of this survey, it lacks detail for use in high-intensity, small-area projects. These projects require additional onsite study by various technical specialists, including soil scientists.

There are many uses for the information in this report. Some are quite simple and apparent, while others have not yet been conceived. The real work lies ahead in effectively and fully using this information. The use of this information is achieved best by those with full understanding of the interrelationships of the basic earth features.

Examples of how SRI information can be used are listed below:

1. Transportation Planning - This is an area where the soils information has key application. Conditions and problems can be met or avoided based on information such as landscape stability, soil depth, soil drainage and/or bedrock type and competency. Roads may be selected that avoid unstable areas, and construction and maintenance costs may be more accurately estimated. Sources of road rock may also be located through use of soil maps. SRI information is available for assistance in road design such as cutbank ratios and road rock thickness.

2. Recreation Planning - The SRI information indicates the various soil suitabilities and limitations that may apply to ski areas, camping areas, trails, roads, and other aspects of recreation development. By knowing the soil suitabilities and limitations, the planner is better able to make plans that are consistent with the capabilities of the land.

3. Land Use Planning - The soils information in this report should be incorporated into the multiple use plans. This is the kind of information that will support the policy and directives, and assist in multiple use. An example of use would be to color the maps in the Atlas to illustrate various soil management relationships. For instance, the maps can be colored to show stability, erosion, etc.

4. 5-Year Action Plan - This report provides information on the relative susceptibility of soil and other resource damage from timber harvest, road construction, and other timber-related activities. Provided also, is information on regeneration problems and erosion control requirements.

5. Timber Management Plan - The soils information can suggest direction and support policy for allowable cut determinations, logging systems, fuel reduction methods, operating season, and deferred cutting areas. With a better understanding of problems and their location, the cut can be planned so that at a given time the majority of cutting is not taking place in critical areas. By spreading out the harvest on the more critical areas, more time would be available for proper road location and design on these areas. Also, within a few years, logging technology may have developed so that harvest methods are compatible with critical soil areas without causing excessive soil and resource damage.

6. Environmental Analysis - Any report involving the impact of a management activity requires soils input. Whether it is a ski area, recreation, or damsite proposal, there are soil factors that must be considered to make the report complete.

7. Land Appraisal and Exchange - Soils information should be used for land appraisal and exchange activities. The value of the land is related to such soil factors as texture, depth, drainage, productivity, and stability.

8. The following is a list of more specific uses of the report. These uses are adaptable and compatible with the survey data and are well within the scope and intensity of the survey:

   a. Engineering Testing - By using the soil maps, more efficient testing can be done. The soil maps can be used to determine which soils are most susceptible to certain engineering problems. These problem soils may need more closely spaced testing than soils in which few problems are anticipated.

   b. Reservoir Sites - This report gives information that can be used to determine problems that may be encountered for a reservoir site. The soil interpretations will enable the planner to better determine the general suitability of a particular site and the soil stability as they affect reservoir uses.

   c. Hydrologic Analysis - The information in the SRI is sufficient to determine a broad hydrologic analysis and water balance on the Forest, and as a basis for comparisons between larger watersheds.

   d. Timber Harvest Methods - Data about soil capability and regeneration potential are useful for arriving at silvicultural prescriptions to fit particular soils. Additional facts known about the potential for erosion and landscape stability will encourage selection of timber harvest methods that cause minimum damage to soil and other resources.

   e. Timber Harvest and Road Construction Operating Season - These activities should be scheduled at times when they will cause minimum soil damage. Many soils are subject to damage (compaction, erosion, site deterioration) by timber harvest activities when overly wet or excessively dry.

   f. Erosion Control - Since there is wide variability in soil texture, depth, structure, permeability, drainage, and topography, wide differences also occur in the ability of the soil to resist erosion. Forest soils are rated as to their potential erosion class. The land manager can use this information to determine which areas will need special erosion protective measures. These will need to be developed on a site-by-site basis.

   g. Recreational Developments - Several kinds of information are available in this report to assist in selecting favorable sites for campground development. Among these are soil and landform properties and characteristics, general ratings of filter drainage field suitability, the relative resistance of soil and vegetation to site deterioration, and indications of special problems which may be encountered.

MAPPING UNIT

AND

LANDTYPE

INFORMATION

DEFINITIONS OF MAPPING UNITS

This section defines the numbers and symbols found on the soil maps. The numbers identify mapping units. The symbols represent land features important to land management that are too small to delineate at the scale used for this survey. The symbols used in this survey are listed below:


Dry meadow


Rock outcrop


Talus


Unstable area


Wet spot and small marshes


Slump or slide scarp


Slump


Avalanche or debris slide track

Mapping Units [1/] are shown on the soil maps as numbers 1 through 199. Mapping units contain a dominant landtype which accounts for at least 70 percent of the mapping unit delineation.

The dominant landtype of the mapping unit is described in the mapping unit description and identified by the same number as used for the mapping unit. Within the mapping unit delineation other landtypes may occur. Those most commonly associated with the dominant landtype of the mapping unit are included in the description as inclusions of other landtypes. These landtypes account for no more than 30 percent of the mapping unit.

The management interpretations presented in the Atlas apply only to dominant landtype in each mapping unit. The interpretations for most inclusions within any mapping unit are listed on the interpretative tables according to the appropriate landtype number. The Table of Some Mapping Unit Characteristics, Features and Qualities and Table of Bedrock Characteristics of Mapping Units are also numbered according to the dominant landtype in the mapping unit and apply to that dominant landtype.

1/ Mapping units contain a dominant taxonomic unit.

Mapping Unit Complexes - Many numbers shown on the maps range from 200 to 659. These numbers are called "Mapping Unit Complexes". These are Mapping Units used in areas where two or three defined landtypes are present in an arrangement too complex to separate at the one-inch per mile scale. The following legend indicates the landtype components of the complex and the percentage of each component. For example, Mapping Unit 313 is composed of approximately 50 percent landtype 112 and 50 percent landtype 73. In this example to find the information applicable refer to both Mapping Units 112 and 73 for description, interpretations, etc.

LEGEND OF COMPLEXES

Mapping Unit Number	Mapping Unit Components and Percent
200	70 percent Unit 2 and 30 percent Unit 3
201	60 percent Unit 9 and 40 percent Unit 10
202	60 percent Unit 21 and 40 percent Unit 11
203	50 percent Unit 21 and 50 percent Unit 22
204	50 percent Unit 21 and 50 percent Unit 23
205	60 percent Unit 22 and 40 percent Unit 12
206	40 percent Unit 22, 40 percent Unit 25 and 20 percent Unit 100
207	60 percent Unit 24 and 40 percent Unit 23
208	50 percent Unit 21 and 50 percent Unit 24
209	70 percent Unit 100 and 30 percent Unit 5
211	60 percent Unit 27 and 40 percent Unit 21
212	60 percent Unit 28 and 40 percent Unit 22
213	50 percent Unit 22, 30 percent Unit 13 and 20 percent Unit 100
222	50 percent Unit 2 and 50 percent Unit 32
223	60 percent Unit 37 and 40 percent Unit 32
224	60 percent Unit 33 and 40 percent Unit 116
226	60 percent Unit 46 and 40 percent Unit 2
240	60 percent Unit 101 and 40 percent Unit 22

LEGEND OF COMPLEXES

Mapping Unit Number	Mapping Unit Components and Percent
241	60 percent Unit 102 and 40 percent Unit 22
242	60 percent Unit 103 and 40 percent Unit 22
243	60 percent Unit 103 and 40 percent Unit 25
244	70 percent Unit 103 and 30 percent Unit 100
245	50 percent Unit 104 and 50 percent Unit 22
246	70 percent Unit 105 and 30 percent Unit 13
247	60 percent Unit 105 and 40 percent Unit 22
248	60 percent Unit 25 and 40 percent Unit 105
249	40 percent Unit 105, 30 percent Unit 25 and 30 percent Unit 12
250	70 percent Unit 105 and 30 percent Unit 100
251	40 percent Unit 22, 30 percent Unit 108 and 30 percent Unit 106
252	60 percent Unit 106 and 40 percent Unit 12
253	50 percent Unit 106 and 50 percent Unit 22
254	60 percent Unit 25 and 40 percent Unit 106
255	70 percent Unit 107 and 30 percent Unit 100
256	60 percent Unit 107, 25 percent Unit 22 and 15 percent Unit 100
257	60 percent Unit 107 and 40 percent Unit 25
258	70 percent Unit 108 and 30 percent Unit 22
259	70 percent Unit 101 and 30 percent Unit 100
260	70 percent Unit 110 and 30 percent Unit 21
261	70 percent Unit 111 and 30 percent Unit 3
262	60 percent Unit 111 and 40 percent Unit 21
263	40 percent Unit 21, 30 percent Unit 111 and 30 percent Unit 116

LEGEND OF COMPLEXES

Mapping Unit Number	Mapping Unit Components and Percent
264	50 percent Unit 112 and 50 percent Unit 21
265	40 percent Unit 23, 30 percent Unit 112 and 30 percent Unit 116
266	60 percent Unit 113 and 40 percent Unit 21
267	70 percent Unit 115 and 30 percent Unit 2
268	60 percent Unit 115 and 40 percent Unit 21
269	40 percent Unit 116, 30 percent Unit 115 and 30 percent Unit 21
270	50 percent Unit 116 and 50 percent Unit 21
271	50 percent Unit 116 and 50 percent Unit 23
272	50 percent Unit 117 and 50 percent Unit 11
273	60 percent Unit 117 and 40 percent Unit 21
274	60 percent Unit 117 and 40 percent Unit 23
275	50 percent Unit 119 and 50 percent Unit 21
276	60 percent Unit 120 and 40 percent Unit 3
277	50 percent Unit 110 and 50 percent Unit 2
278	60 percent Unit 116 and 40 percent Unit 27
279	70 percent Unit 110 and 30 percent Unit 3
283	50 percent Unit 111 and 50 percent Unit 112
286	60 percent Unit 116 and 40 percent Unit 112
287	60 percent Unit 116 and 40 percent Unit 115
290	50 percent Unit 45 and 50 percent Unit 101
291	50 percent Unit 41 and 50 percent Unit 101
292	50 percent Unit 102 and 50 percent Unit 103
293	50 percent Unit 37 and 50 percent Unit 103
294	50 percent Unit 37 and 50 percent Unit 107

LEGEND OF COMPLEXES

Mapping Unit Number	Mapping Unit Components and Percent
298	50 percent Unit 12 and 50 percent Unit 105
299	50 percent Unit 22, 30 percent Unit 108 and 20 percent Unit 100
301	40 percent Unit 103, 30 percent Unit 63 and 30 percent Unit 22
302	40 percent Unit 103, 30 percent Unit 63 and 30 percent Unit 25
304	40 percent Unit 104, 30 percent Unit 82 and 30 percent Unit 22
305	40 percent Unit 22, 30 percent Unit 105 and 30 percent Unit 81
306	50 percent Unit 25, 25 percent Unit 105 and 25 percent Unit 81
307	40 percent Unit 106, 30 percent Unit 82 and 30 percent Unit 22
308	40 percent Unit 112, 30 percent Unit 73 and 30 percent Unit 21
310	50 percent Unit 116 and 50 percent Unit 75
311	50 percent Unit 110 and 50 percent Unit 71
312	60 percent Unit 111 and 40 percent Unit 72
313	50 percent Unit 112 and 50 percent Unit 73
314	40 percent Unit 112, 30 percent Unit 73 and 30 percent Unit 77
315	50 percent Unit 115 and 50 percent Unit 91
316	50 percent Unit 116 and 50 percent Unit 92
317	50 percent Unit 117 and 50 percent Unit 92
319	50 percent Unit 120 and 50 percent Unit 98
321	60 percent Unit 101 and 40 percent Unit 61
322	50 percent Unit 103 and 50 percent Unit 63
323	60 percent Unit 103 and 40 percent Unit 67
324	60 percent Unit 104 and 40 percent Unit 64
325	60 percent Unit 104 and 40 percent Unit 82

LEGEND OF COMPLEXES

Mapping Unit Number	Mapping Unit Components and Percent
326	60 percent Unit 105 and 40 percent Unit 81
327	60 percent Unit 105 and 40 percent Unit 83
328	50 percent Unit 107 and 50 percent Unit 89
331	60 percent Unit 108 and 40 percent Unit 87
337	60 percent Unit 73 and 40 percent Unit 27
338	60 percent Unit 28 and 40 percent Unit 64
339	60 percent Unit 27 and 40 percent Unit 75
340	70 percent Unit 71 and 30 percent Unit 3
341	60 percent Unit 71 and 40 percent Unit 21
342	70 percent Unit 72 and 30 percent Unit 21
343	60 percent Unit 73 and 40 percent Unit 2
344	60 percent Unit 73 and 40 percent Unit 3
345	60 percent Unit 73 and 40 percent Unit 21
346	60 percent Unit 75 and 40 percent Unit 21
348	70 percent Unit 77 and 30 percent Unit 3
349	70 percent Unit 76 and 30 percent Unit 3
350	70 percent Unit 61 and 30 percent Unit 50
351	60 percent Unit 61 and 40 percent Unit 22
352	70 percent Unit 63 and 30 percent Unit 12
353	70 percent Unit 63 and 30 percent Unit 22
354	70 percent Unit 63 and 30 percent Unit 50
355	70 percent Unit 64 and 30 percent Unit 22
356	70 percent Unit 64 and 30 percent Unit 50

LEGEND OF COMPLEXES

Mapping Unit Number	Mapping Unit Components and Percent
358	70 percent Unit 67 and 30 percent Unit 50
360	60 percent Unit 91 and 40 percent Unit 21
361	50 percent Unit 92, 25 percent Unit 21 and 25 percent Unit 23
363	70 percent Unit 93 and 30 percent Unit 21
364	50 percent Unit 93 and 50 percent Unit 27
365	70 percent Unit 92 and 30 percent Unit 24
366	60 percent Unit 92 and 40 percent Unit 27
367	60 percent Unit 92 and 40 percent Unit 11
368	60 percent Unit 92 and 40 percent Unit 21
370	70 percent Unit 81 and 30 percent Unit 50
371	70 percent Unit 81 and 30 percent Unit 100
372	40 percent Unit 81, 30 percent Unit 89 and 30 percent Unit 22
373	60 percent Unit 82 and 40 percent Unit 22
374	60 percent Unit 81 and 40 percent Unit 22
375	60 percent Unit 82 and 40 percent Unit 25
376	50 percent Unit 83 and 50 percent Unit 43
377	70 percent Unit 87 and 30 percent Unit 22
378	70 percent Unit 82 and 30 percent Unit 50
379	70 percent Unit 88 and 30 percent Unit 50
380	60 percent Unit 82 and 40 percent Unit 12
381	60 percent Unit 71 and 40 percent Unit 76
382	60 percent Unit 72 and 40 percent Unit 76
383	50 percent Unit 73 and 50 percent Unit 77

LEGEND OF COMPLEXES

Mapping Unit Number	Mapping Unit Components and Percent
384	50 percent Unit 75 and 50 percent Unit 95
385	70 percent Unit 87 and 30 percent Unit 50
386	50 percent Unit 82 and 50 percent Unit 28
387	45 percent Unit 22, 30 percent Unit 82 and 25 percent Unit 12
388	60 percent Unit 87 and 40 percent Unit 12
389	50 percent Unit 81 and 50 percent Unit 12
391	60 percent Unit 61 and 40 percent Unit 69
393	50 percent Unit 63 and 50 percent Unit 67
394	60 percent Unit 63 and 40 percent Unit 69
397	60 percent Unit 67 and 40 percent Unit 69
398	50 percent Unit 69 and 50 percent Unit 41
399	50 percent Unit 69 and 50 percent Unit 77
400	60 percent Unit 91 and 40 percent Unit 33
401	60 percent Unit 98 and 40 percent Unit 91
402	60 percent Unit 92 and 40 percent Unit 95
404	50 percent Unit 91 and 50 percent Unit 94
410	60 percent Unit 81 and 40 percent Unit 83
411	70 percent Unit 81 and 30 percent Unit 89
412	60 percent Unit 87 and 40 percent Unit 89
414	60 percent Unit 84 and 40 percent Unit 89
421	50 percent Unit 73 and 50 percent Unit 91
425	50 percent Unit 63 and 50 percent Unit 82
430	60 percent Unit 51 and 40 percent Unit 28

LEGEND OF COMPLEXES

Mapping Unit Number	Mapping Unit Components and Percent
431	70 percent Unit 51 and 30 percent Unit 50
432	70 percent Unit 53 and 30 percent Unit 12
433	60 percent Unit 53 and 40 percent Unit 28
434	70 percent Unit 53 and 30 percent Unit 50
435	70 percent Unit 54 and 30 percent Unit 50
436	60 percent Unit 54 and 40 percent Unit 58
437	70 percent Unit 56 and 30 percent Unit 2
438	60 percent Unit 56 and 40 percent Unit 27
439	60 percent Unit 57 and 40 percent Unit 50
442	50 percent Unit 52 and 50 percent Unit 54
500	60 percent Unit 131 and 40 percent Unit 22
501	70 percent Unit 131 and 30 percent Unit 130
502	70 percent Unit 133 and 30 percent Unit 130
503	70 percent Unit 134 and 30 percent Unit 130
504	60 percent Unit 133 and 40 percent Unit 22
505	70 percent Unit 141 and 30 percent Unit 3
506	70 percent Unit 141 and 30 percent Unit 130
507	60 percent Unit 143 and 40 percent Unit 21
509	40 percent Unit 134, 30 percent Unit 130 and 30 percent Unit 22
521	60 percent Unit 141 and 40 percent Unit 40
523	60 percent Unit 143 and 40 percent Unit 42
524	60 percent Unit 143 and 40 percent Unit 145
526	50 percent Unit 145 and 50 percent Unit 42

LEGEND OF COMPLEXES

Mapping Unit Number	Mapping Unit Components and Percent
531	50 percent Unit 131 and 50 percent Unit 41
533	60 percent Unit 133 and 40 percent Unit 43
534	60 percent Unit 133 and 40 percent Unit 137
539	50 percent Unit 135 and 50 percent Unit 28
540	70 percent Unit 151 and 30 percent Unit 150
541	50 percent Unit 152 and 50 percent Unit 28
542	70 percent Unit 152 and 30 percent Unit 150
543	70 percent Unit 153 and 30 percent Unit 22
544	70 percent Unit 153 and 30 percent Unit 150
545	60 percent Unit 154 and 40 percent Unit 12
546	50 percent Unit 154 and 50 percent Unit 28
547	50 percent Unit 154 and 50 percent Unit 29
548	70 percent Unit 154 and 30 percent Unit 150
549	40 percent Unit 152, 40 percent Unit 22 and 20 percent Unit 150
550	50 percent Unit 151 and 50 percent Unit 22
551	60 percent Unit 158 and 40 percent Unit 27
552	70 percent Unit 157 and 30 percent Unit 21
555	40 percent Unit 155, 30 percent Unit 150 and 30 percent Unit 3
556	60 percent Unit 155 and 40 percent Unit 21
559	50 percent Unit 154 and 50 percent Unit 25
561	60 percent Unit 151 and 40 percent Unit 45
562	50 percent Unit 152 and 50 percent Unit 47
565	50 percent Unit 155 and 50 percent Unit 44

Mapping Unit Number	Mapping Unit Components and Percent
567	60 percent Unit 157 and 40 percent Unit 32
600	70 percent Unit 161 and 30 percent Unit 160
601	70 percent Unit 162 and 30 percent Unit 160
602	70 percent Unit 163 and 30 percent Unit 160
603	60 percent Unit 164 and 40 percent Unit 12
604	70 percent Unit 164 and 30 percent Unit 160
605	70 percent Unit 167 and 30 percent Unit 3
606	70 percent Unit 168 and 30 percent Unit 21
607	60 percent Unit 164 and 40 percent Unit 22
609	60 percent Unit 162 and 40 percent Unit 22
610	50 percent Unit 164 and 50 percent Unit 28
611	50 percent Unit 167 and 50 percent Unit 27
612	50 percent Unit 168 and 50 percent Unit 27
633	70 percent Unit 183 and 30 percent Unit 180
634	70 percent Unit 184 and 30 percent Unit 180
635	60 percent Unit 184 and 40 percent Unit 28
636	60 percent Unit 186 and 40 percent Unit 27
637	60 percent Unit 183 and 40 percent Unit 28
650	60 percent Unit 192 and 40 percent Unit 12
651	50 percent Unit 192 and 50 percent Unit 22
652	70 percent Unit 192 and 30 percent Unit 190
653	40 percent Unit 192, 30 percent Unit 190 and 30 percent Unit 22

LEGEND OF COMPLEXES

Mapping Unit Number	Mapping Unit Components and Percent
654	50 percent Unit 191 and 50 percent Unit 22
655	70 percent Unit 194 and 30 percent Unit 28
657	60 percent Unit 197 and 40 percent Unit 21
659	70 percent Unit 198 and 30 percent Unit 27

KEY TO MAPPING UNITS

The key on the following 3 pages is designed to aid the user in determining the similarities and differences between Landtype units. Miscellaneous Landtypes and Deep Soil Landtypes are not included in this key. Look to the Mapping Unit Descriptions to determine the various relationships between these two groups of Landtypes.

KEY TO LANDTYPES

Bedrock	Soil Unit	Depth of Soil to Bedrock: Rock Outcrop	Very Shallow	Shallow	Moderately Deep	Deep	Surface Layer: Ash Present	Ash Locally Absent	Ash Locally Present	Ash Absent	Subsoil or Buried Soil Texture Class: Coarse	Moderately Coarse	Medium	Moderately Fine	Fine	Landform: Steep, nondissected to slightly dissected, stable sideslopes of greater than 35% slope.	Steep, highly dissected, stable sideslopes of greater than 35% slope.	Steep, unstable sideslopes of greater than 35% slope.	Smooth, stable landforms of less than 35% slope.	Other landforms (See first paragraph of Mapping Unit Description).	Overstory Vegetation: Upper Forest Association	Lodgepole Pine	Associated Species Stands	P. Pine w/< 45% other Sp.	Ponderosa Pine	Natural Stability Class: I	II	III	IV
Rhyolitic Rocks	50	X								X							X						X				X		
	51									X						X								X			X		
	52										X							X									X		
	53										X						X							X			X		
	54								X										X					X			X		
	55										X																X		
	56										X	X				X					X						X		
	57						X					X	X									X					X		
Pyroclastic Rock	58	Very deep						X								X						X				X		
	61							X								X						X				X		
	62							X								X						X				X		
	63							X								X						X				X		
	64							X								X							X			X		
	65							X									X					X				X		
	67							X										X				X				X		
	69							X										X				X				X		
	71							X										X				X				X		
	72							X										X					X			X		
	73							X											X			X				X		
	75							X											X			X				X		
	76							X											X			X				X		
	77										X						X										X		
	81										X						X										X		
	82										X						X										X		
	83										X						X										X		
	84											X					X										X		
	85											X						X									X		
	86												X					X									X		
	87												X							X							X		
	88												X								X						X		
	89												X								X						X		
	91												X								X						X		
	92												X									X					X		
	93												X									X					X		
	94												X									X					X		
	95											X										X					X		
	96											X										X					X		
	97											X										X					X		
	98												X									X					X		
	99												X									X					X		

KEY TO LANDTYPES (cont'd.)

Bedrock	Soil Unit	Depth of Soil to Bedrock: Rock Outcrop	Very Shallow	Shallow	Moderately Deep	Deep	Surface Layer: Ash Present	Ash Locally Absent	Ash Locally Present	Ash Absent	Subsoil or Buried Soil Texture Class: Coarse	Moderately Coarse	Medium	Moderately Fine	Fine	Landform: Steep, nondissected to slightly dissected, stable sideslopes of greater than 35% slope.	Steep, highly dissected, stable sideslopes of greater than 35% slope.	Steep, unstable sideslopes of greater than 35% slope.	Smooth, stable landforms of less than 35% slope.	Other landforms (See first paragraph of Mapping Unit Description).	Overstory Vegetation: Upper Forest Association	Lodgepole Pine	Associated Species Stands	P. Pine w/< 45% other Sp.	Ponderosa Pine	Natural Stability Class: I	II	III	IV
Andesite And Basalt Rocks	100	X								X							X						X				X		
	101							X								X								X			X		
	102						X									X						X				X		
	103						X									X						X				X		
	104							X								X							X			X		
	105								X							X							X			X		
	106								X							X								X		X		
	107							X							X								X			X		
	108							X									X						X			X		
	110						X								X				X			X				X		
	111						X								X				X				X			X		
	112						X								X				X				X			X		
	113						X								X				X					X		X		
	115							X								X				X				X			X		
	116							X								X				X					X		X		
	117							X								X				X					X	X	X		
	119								X							X				X							X		
	120						X								X				X				X			X		
Intrusive Rocks	130	X								X							X						X				X		
	131							X								X				X				X			X		
	132							X								X				X					X		X		
	133							X								X				X					X		X		
	134							X									X			X					X		X		
	135								X							X				X							X		
	136								X								X										X		
	137	Very deep							X								X							X			X		
	141							X										X				X					X		
	142							X										X				X					X		
	143								X									X				X					X		
	144								X									X				X					X		
	145							X										X				X					X		
	146							X										X				X					X		
	147						X									X						X					X		

KEY TO LANDTYPES (cont'd.)

Bedrock	Soil Unit	Depth of Soil to Bedrock: Rock Outcrop	Very Shallow	Shallow	Moderately Deep	Deep	Surface Layer: Ash Present	Ash Locally Absent	Ash Locally Present	Ash Absent	Subsoil or Buried Soil Texture Class: Coarse	Moderately Coarse	Medium	Moderately Fine	Fine	Landform: Steep, nondissected to slightly dissected, stable sideslopes of greater than 35% slope.	Steep, highly dissected, stable sideslopes of greater than 35% slope.	Steep, unstable sideslopes of greater than 35% slope.	Smooth, stable landforms of less than 35% slope.	Other landforms (See first paragraph of Mapping Unit Description)	Overstory Vegetation: Upper Forest Association	Lodgepole Pine	Associated Species Stands	P. Pine w/< 45% other Sp.	Ponderosa Pine	Natural Stability Class: I	II	III	IV
Meta-Gabbro, Gabbro or Granitic Gneiss w/some Coarse Sedimentary Rocks	150	X							X							X					X						X		
	151								X							X							X				X		
	152								X							X					X						X		
	153									X																				
	154								X											X			X				X		
	155								X											X							X		
	156								X											X							X		
	157									X																				
	158															X							X							
Meta-Sedimentary Rocks	160	X							X							X											X		
	161								X								X										X		
	162								X							X													
	163									X							X													
	164									X										X			X						
	165								X											X							X		
	166								X											X							X		
	167									X																				
	168 1/									X																				
	169 2/															X							X							
Schist Rocks	180	X								X							X											X		
	181									X							X											X		
	182									X										X										
	183									X										X										
	184									X																				
	185									X																				
	186								X																					
	189															X														
Serpentine Rocks	190	X								X							X											X		
	191									X							X											X		
	192									X										X										
	193									X										X										
	194									X																				
	195									X																				
	196									X																				
	197									X																				
	198															X							X							
	199							X	X																					

1/ Site Class IV and V Ponderosa Pine.
2/ Site Class III Ponderosa Pine.

MAPPING UNIT DESCRIPTIONS

This section contains descriptions for each of the Mapping Units.

Most of the Mapping Units are described in detail. They have a definable range of characteristics for landform, soil, geology and vegetation. The exceptions to this generalization are called "Miscellaneous Units". Miscellaneous Mapping Units are either limited in extent or quite variable in composition. Short narratives are used to describe these Units. Included in this subgroup are Mapping Units 1 through 29 and rock outcrop units 50, 100, 130, 150, 160, 180 and 190.

Information in Mapping Unit Descriptions

The first paragraph describes landform, elevation ranges and vegetation. The second paragraph indicates landtypes most likely to be within the Mapping Unit as inclusions. The third paragraph gives a brief generalized description of the primary soil. The fourth paragraph briefly describes the bedrock occurring in the mapping unit. Reference should be made to Appendix VI for definition of terms used in these descriptions.

Range of Profile Characteristics

This describes the range of soil profile characteristics that have been established for the dominant soil within the mapping unit.

MAPPING UNIT DESCRIPTIONS 1/

Mapping Unit 1 - Pasture and cultivated lands. General private lands which are being used for cultivated crops or pasture, usually fenced and locally irrigated. Soils are generally loams and slopes are less than 20 percent.

Mapping Unit 2 - Dry or moist meadows. This mapping unit consists of deep to very deep soils. The surface soils are generally thin, moderately coarse to medium textured, well structured and high in organic matter. The subsoils are generally thick and range from medium to moderately fine texture. These soils are well to moderately well drained. Slopes range from 0 to 20 percent. Grasses and forbs are the primary vegetation. The most common inclusion is landtype 3.

Mapping Unit 3 - Marshland and wet meadows. This mapping unit consists of depressional areas that are seasonably ponded. The soils are slowly permeable, imperfectly to poorly drained, and normally support sedges, rushes, grasses and willow. The most common inclusions are Landtypes 2, 76, 77, 94, 95, 110, 111, 120 and 141.

Mapping Unit 4 - Mine tailings. Refuse of mining operations, generally well washed stones, cobbles and gravel.

Mapping Unit 5 - Talus slopes. This mapping unit consists of colluvial, bouldery sideslopes of generally greater than 35 percent slope. This mapping unit has limited vegetation. Common inclusions are Landtypes 6, 7, 8, 9, 10, 50 and 100.

Mapping Unit 6 - High elevation rock outcrop, talus and meadows. This mapping unit consists primarily of rock outcrop, talus and meadows. Soils occur intermittently and are very shallow, gravelly loams or sandy loams. Some coarse textured glacial till remnants may occur locally. This landtype appears on high elevation ridgetops and cirque topography. Bedrock is hard. Slopes range from 20 to greater than 100 percent.

Mapping Unit 7 - Rugged, rocky landforms with low-site timber. This mapping unit consists of rock outcrops, talus slopes and avalanche tracks. Soils are shallow (commonly 12-36 inches), and generally are gravelly, moderately coarse to coarse-textured. The bedrock is generally hard. This mapping unit occurs on ridgetops, cirque basins and upper sideslopes. It supports an upper forest association and/or low site class associated species stands. Severe management problems occur because of topographic and climatic limitations. Slopes generally range from 50 to greater than 100 percent.

1/ Mapping Units 1 through 29 and 50, 100, 130, 150, 160, 180, 190 are miscellaneous units and are not described in detail.

Mapping Unit 8 - Highly dissected landforms with low-site timber. This mapping unit consists of an intense pattern of parallel stream dissections; long, narrow talus slopes, and/or avalanche tracks. Soils are generally shallow to moderately deep (12 to 36 inches), gravelly and moderately coarse-textured. They generally support an upper forest association or low-site class associated species stands. This mapping unit has severe management problems because of the dissection and/or avalanche tracks. Slopes generally range from 50 to 90 percent.

Mapping Unit 9 - Rugged, rocky grassland landforms. This mapping unit consists of rock outcrops, talus slopes and bunchgrass sideslopes. Slopes are dissected and occur at lower elevations. Soils are shallow to moderately deep, residual and colluvial materials, gravelly to very gravelly, loam to silty clay loam over hard basalt with some pyroclastic rock. Locally, coarse grained metasedimentary bedrock occurs. This mapping unit supports some brush, primarily in drainages and on talus slopes, bunchgrass and forbs with widely scattered ponderosa pine and Douglas-fir.

Mapping Unit 10 - Steep, rugged, timbered landforms. This mapping unit is similar to Mapping Unit 7 with the exception being that it occurs at lower elevations and supports better timber. Soils are generally shallow (12 to 36 inches), gravelly and medium textured. They generally support timber (ponderosa pine, ponderosa pine/Douglas-fir or associated species stands) and an understory of pinegrass, ninebark and other shrubs. The bedrock is generally hard basalt.

Mapping Unit 11 - Scabland/Mountain Mahogony, Gentle Slopes. This mapping unit consists of very shallow (less than 10 inches), well drained, gravelly loam soils over various types of bedrock. Rock exposures occur on up to 50 percent of the surface area. It occurs on gentle slopes of less than 35 percent. Vegetation consists of mountain mahogony, wax current, pinegrass, elk sedge, squirrel tail, balsamroot and other forbs. Some ponderosa pine and juniper may be present.

Mapping Unit 12 - Scabland/Mountain Mahogony, Steep Slopes. This mapping unit is similar to mapping unit 11 with the exception that it occurs on steep (greater than 35 percent) slopes.

Mapping Unit 13 - Shrubland Stringers. This mapping unit consists of very shallow to shallow (0 to 20 inches) well drained, nongravelly to gravelly (locally very gravelly) loam to clay loam (most commonly gravelly loam) soils over hard to moderately hard rock. Basalt bedrock is most common. It occurs on steep, convex slopes with rock outcrops being common. Vegetation consists of grasses (bluebunch wheatgrass, Idaho fescue, elk sedge), forbs (yarrow, balsamroot) and shrubs (snowberry, ninebark, wax current, oceanspray, spirea).

Mapping Unit 14 - Landslide Headwalls. This mapping unit consists of steep, uneven and dissected slopes at the head of old landslide sites. From an aerial view it generally has a crescent shape. Portions of the mapping unit remain potentially unstable and periodic mass wasting will occur. The most common inclusions are landtypes 5, 50, 100, 69, 89, 103 and 63.

Mapping Unit 21 - Scabland-Stiff Sagebrush/Forbs, Gentle Slopes. This mapping unit consists of very shallow (less than 10 inches), well drained, gravelly silt to loam soils over various hard rock types. Rock exposures are locally common. This mapping unit occurs on gentle slopes of less than 25 percent and supports stiff sagebrush, Wyeth buckwheat, Sandberg bluegrass along with other grasses and forbs.

Mapping Unit 22 - Scabland-Stiff Sagebrush/Forbs, Steep Slopes. This mapping unit is similar to mapping unit 21 with the exception that it occurs on slopes of greater than 25 percent.

Mapping Unit 23 - Sandberg Bluegrass Scabland. This mapping unit consists of very shallow, less than 10 inches, well to moderately well drained, nongravelly to gravelly, sandy loam to silt loam soils over various hard rock types, basalt bedrock being most common. It occurs on gentle ridgetops of less than 25 percent. Vegetation consists primarily of Sandberg bluegrass along with balsamroot, biscuitroot and a few other grasses and forbs.

Mapping Unit 24 - Bunchgrass Land, Gentle. This mapping unit consists of shallow to moderately shallow, locally very shallow, 6 to 36 inches, nongravelly to gravelly, sandy loam to silt soils over various types of hard rock types, basalt bedrock being most common. It occurs on gentle slopes of less than 25 percent. Vegetation consists of bluebunch wheatgrass, Idaho fescue, Sandberg bluegrass, yarrow and a few other grasses and forbs.

Mapping Unit 25 - Bunchgrass Lands, Steep. This mapping unit is similar to mapping unit 24 with the exception that it occurs on steep (greater than 25 percent) slopes.

Mapping Unit 27 - Big Sagebrush/Bunchgrass Lands, Gentle. This mapping unit consists of shallow to moderately deep, 15 to 36 inches, nongravelly to gravelly, sandy loam to clay loam soils over hard to moderately hard rock types including basalt, pyroclastic, granodiorite and serpentine bedrock. It occurs on gentle ridgetops and benches of less than 25 percent slope. Vegetation consists primarily of big sagebrush and bluebunch wheatgrass.

Mapping Unit 28 - Big Sagebrush/Bunchgrass Lands, Steep. This mapping unit is similar to mapping unit 27 with the exception that it occurs on steep (greater than 25 percent) slopes.

Mapping Unit 29 - Juniper Lands. This mapping unit consists of very shallow to shallow, 4 to 20 inches, nongravelly to gravelly, sandy loam to clay loam soils over primarily basalt or pyroclastic bedrock. It occurs on gentle undulating slopes of less than 40 percent. Vegetation consists of sparse Juniper with sagebrush (big, low and stiff) bluebunch wheatgrass, Idaho fescue, yarrow, Sandberg bluegrass and a few other grasses and forbs.

MAPPING UNIT 31

Landtype 31 occurs on gentle valley bottoms, alluvial fans and terraces of less than 25 percent slope. This landtype ranges in elevation from 5300 to 6100 feet and supports an upper forest association 1/ or lodgepole pine stands.

Mapping Unit 31 consists dominantly of landtype 31 and minor amounts of landtype 32 which is alluvium in narrow valley bottoms at lower elevations and landtype 33 which is a broad alluvial fan at lower elevations.

Soil 31 is a very deep, nonplastic soil derived from aeolian deposits and/or alluvium. Surface soils may be thin to moderately thick, silt loam ash deposits or thin, gravelly to very gravelly sands, loamy sands or sandy loams. Buried soils or subsoils are generally very thick, very cobbly and gravelly, sands or loamy sands. This soil is well or excessively drained to the water table. Permeability is very rapid or rapid.

Bedrock is variable at depth generally greater than 60 inches.

Range of Profile Characteristics of Soil 31

Litter:	Needles, leaves, twigs and decomposing organic matter. 1 to 2 inches thick.
Surface Layers: 2/	Light yellowish brown to dark brown silt loam; single grained or weak, fine, subangular blocky structure; 0 to 10 percent subangular gravel by volume; nonsticky, nonplastic; pH ranges from 5.5 to 6.5; 4 to 30 inches thick.
Buried Layers:	Brown to dark reddish brown, very gravelly and cobbly, sand to loamy sand; single grained or weak, fine, crumb structure; 55 to 80 percent rounded gravel, cobbles and stones by volume; nonsticky, nonplastic; pH ranges from 5.5 to 6.5; greater than 60 inches thick.

1/ A predominance of Engelmann spruce and subalpine fir with lodgepole pine, western larch and white fir occurring to lesser extent.

2/ Locally ash is absent. Surface soils are most commonly very gravelly sands, loamy sands or sandy loams under these situations.

MAPPING UNIT 32

Landtype 32 occurs in the valley bottom position in narrow valleys. Slopes generally are less than 10 percent. This landtype ranges in elevation from 2000 to 5400 feet and supports an associated species stand 1/.

Mapping Unit 32 consists dominantly of landtype 32 and minor amounts of landtype 31 which supports an upper forest association and landtype 33 which is a broad alluvial fan.

Soil 32 is a very deep, nonplastic soil derived from aeolian deposits and/or alluvium. Surface soils may be thin to moderately thick, silt loam ash deposits or thin, nongravelly to gravelly, sandy loams or loams. Buried soils or subsoils are generally very thick, nongravelly to very cobbly and gravelly, sands, loamy sands or sandy loams. This soil is well to excessively drained to the water table. Permeability is very rapid to rapid.

Bedrock is variable at depths generally greater than 60 inches.

Range of Profile Characteristics of Soil 32

Litter:	Needles, leaves, twigs and decomposing organic matter. 1 to 2 inches thick.
Surface Layers: 2/	Light yellowish brown to dark brown, silt loam; single grained or weak, fine, subangular blocky structure; 0 to 10 percent subangular gravel by volume; nonsticky, nonplastic; pH ranges from 5.5 to 6.5; 4 to 40 inches thick.
Buried Layers:	Brown to very dark brown, nongravelly to very cobbly and gravelly, sand to sandy loam; single grained; 25 to 80 percent rounded gravel, cobbles and stones by volume; nonsticky, nonplastic; pH ranges from 5.5 to 7.0; greater than 60 inches thick.

1/ A predominance of white fir, Douglas-fir and western larch with ponderosa pine or lodgepole pine sometimes common.

2/ Locally, ash is absent. Surface soils are most commonly loam to sandy loam under these situations.

MAPPING UNIT 33

Landtype 33 occurs on gentle alluvial fans of less than 35 percent slope. This landtype ranges in elevation from 3000 to 5000 feet and supports an associated species stand 1/ or ponderosa pine/Douglas-fir stands.

Mapping Unit 33 consists dominantly of landtype 33 and minor amounts of landtype 32 which occurs in narrow valley bottoms.

Soil 33 is a very deep, nonplastic soil derived from aeolian deposits and/or alluvium. Surface soils may be thin to moderately thick silt loam ash deposits or thin, gravelly to very gravelly, loams, sandy loams or loamy sands. Buried soils or subsoils are generally very thick, very gravelly and cobbly, sandy loams or loamy sands. This soil is well or excessively drained. Permeability is very rapid or rapid.

Bedrock is variable at depths generally greater than 144 inches.

Range of Profile Characteristics of Soil 33

Litter:	Needles, leaves, twigs and decomposing organic matter. 1 to 2 inches thick.
Surface Layers: 2/	Light yellowish brown to dark brown silt loam; single grained or weak, fine, subangular blocky structure; 0 to 15 percent angular or subangular gravel by volume; nonsticky, nonplastic; pH ranges from 5.5 to 6.5; 4 to 18 inches thick.
Buried Layers:	Very dark grayish brown to dark reddish brown, gravelly and cobbly to very gravelly and cobbly loamy sand to sandy loam; single grained; 40 to 80 percent subangular or subrounded gravel, cobbles and stones by volume; nonsticky, nonplastic; pH ranges from 5.5 to 7.0; greater than 110 inches thick.

1/ A predominance of white fir, Douglas-fir and western larch with ponderosa pine or lodgepole pine sometimes common.

2/ Locally, ash is absent. Surface soils are most commonly gravelly, sandy loam or loam under these situations.

MAPPING UNIT 34

Landtype 34 occurs on alluvial terraces and toeslopes of less than 35 percent. This landtype ranges in elevation from 3800 to 5000 feet and supports primarily ponderosa pine with some ponderosa pine/ Douglas-fir stands and locally pockets of associated species stands.

Mapping Unit 34 consists dominantly of landtype 34 and minor amounts of landtype 168 which is a shallow soil supporting ponderosa pine overlying argillite bedrock.

Soil 34 is a very deep, slightly plastic to plastic soil derived from alluvium. Surface soils generally very thick, gravelly, silty clays, silty clay loams or clay loams. This soil is moderately well drained. Permeability is moderate to slow.

Range of Profile Characteristics of Soil 34

Litter:	Needles, leaves, twigs and decomposing organic matter. 0 to 1 inch thick.
Surface Layers:	Yellowish brown to dark brown, clay loam to silty clay loam; weak to moderate, fine subangular blocky structure; 5 to 30 percent subrounded gravel by volume; slightly sticky to sticky, slightly plastic to plastic; pH ranges from 5.0 to 6.5; 6 to 20 inches thick.
Subsoil Layers: 1/	Yellowish brown to brown, gravelly to very gravelly, clay loam to silty clay; massive; 35 ot 60 percent subrounded or rounded gravel and cobbles by volume; sticky, plastic; pH ranges from 5.5 to 6.5; greater than 84 inches thick.

1/ In a localized area of the upper Little Eagle Creek drainage the buried soils are medium to coarse textured rather than fine textured as portrayed above.

MAPPING UNIT 35

Landtype 35 occurs on alluvial fans and terraces of less than 35 percent. This landtype ranges in elevation from 900 to 1600 feet and supports grasses and forbs.

Mapping Unit 35 consists of landtype 35.

Soil 35 is a very deep, nonplastic soil derived from alluvium. Surface soils are thin sands and loamy sands. Subsoils are generally very thick, very gravelly and stony loams, sandy loams or loamy sands. This soil is well drained. Permeability is rapid.

Bedrock is generally greater than 144 inches deep.

Range of Profile Characteristics of Soil 35

Litter:	Leaves, twigs and decomposing organic matter. 0 to 1 inch thick.
Surface Layers:	Light brown to brown sand or loamy sand; single grained; 0 to 20 percent rounded gravel by volume; nonsticky, nonplastic; pH ranges from 6.0 to 7.0; 15 to 36 inches thick.
Subsoil Layers:	Grayish brown to brown, very gravelly and stony, loamy sand to loam; single grained or massive; 60 to 90 percent rounded gravel, cobbles and stones by volume; nonsticky, nonplastic; pH ranges from 6.5 to 7.5; greater than 100 inches thick.

MAPPING UNIT 36

Landtype 36 occurs on gentle toeslopes and benches of less than 35 percent slope. This landtype ranges in elevation from 3600 to 5700 feet and supports an associated species stand 1/.

Mapping Unit 36 consists dominantly of landtype 36 and minor amounts of landtype 37 which occurs on steeper slopes.

Soil 36 is a very deep to extremely deep, nonplastic soil derived from aeolian deposits and buried colluvium. Surface soils are generally thin, silt loam ash deposits. Buried soils are generally very thick, very gravelly loams or sandy loams. This soil is well drained. Permeability is rapid.

Bedrock is generally composed of hard, highly fractured basalt or andesite rock. Depth to bedrock is generally greater than 84 inches.

Range of Profile Characteristics of Soil 36

Litter:	Needles, leaves, twigs and decomposing organic matter. ½ to 1½ inches thick.
Surface Layers:	Light yellowish brown to dark brown silt loam; single grained to weak, fine, subangular blocky structure; 0 to 15 percent subangular and angular gravel by volume; nonsticky, nonplastic; pH ranges from 5.0 to 6.5; 6 to 30 inches thick.
Buried Layers:	Brown to dark brown, very gravelly loam to sandy loam; single grained or massive; 60 to 80 percent angular and subangular gravel, cobbles and stones by volume; nonsticky to slightly sticky, nonplastic; pH ranges from 5.5 to 6.5; greater than 70 inches thick.

1/ A predominance of white fir, Douglas-fir and western larch with ponderosa pine, lodgepole pine and Engelmann spruce sometimes common.

MAPPING UNIT 37

Landtype 37 occurs on steep, slightly dissected to dissected toeslopes of greater than 35 percent. This landtype ranges in elevation from 3600 to 5700 feet and supports an associated species stand 1/.

Mapping Unit 37 consists dominantly of landtype 37 and minor amounts of landtype 36 which occurs on gentle slopes.

Soil 37 is a very deep to extremely deep, nonplastic soil derived from colluvium or aeolian deposits overlying buried colluvium. Surface soils are generally gravelly to very gravelly loams or sandy loams. Locally, surface soils are thin to moderately thick, loam ash deposits. Subsoils or buried soils are generally very thick, very gravelly loams or sandy loams. This soil is well drained. Permeability is rapid.

Bedrock is generally composed of hard, highly fractured basalt or andesite rock. Depth to bedrock is generally greater than 84 inches.

Range of Profile Characteristics of Soil 37

Litter:	Needles, leaves, twigs and decomposing organic matter. ½ to 1½ inches thick.
Surface Layers: 2/	Brown to dark gray, gravelly to very gravelly, loam to sandy loam; single grained, massive or weak, fine crumb structure; 45 to 80 percent angular or subangular gravel and cobbles by volume; nonsticky to slightly sticky, nonplastic; pH ranges from 5.5 to 6.5; 10 to 24 inches thick.
Subsoil Layers:	Dark brown to brown, very gravelly, loam to sandy loam; single grained or massive; 55 to 80 percent angular or subangular gravel, cobbles or stones by volume; nonsticky, nonplastic; pH ranges from 5.5 to 6.5; greater than 70 inches thick.

1/ A predominance of white fir, Douglas-fir and western larch with ponderosa pine, lodgepole pine and Engelmann spruce sometimes common.

2/ Locally, silt loam ash may be present to a thickness of 30 inches.

MAPPING UNIT 38

Landtype 38 occurs on gentle, dissected alluvial fans and terraces of between 10 and 40 percent slope. This landtype ranges in elevation from 1000 to 3200 feet and supports grasses.

Mapping Unit 38 consists dominantly of landtype 38 and minor amounts of landtypes 24 and 25 which are shallow soils over basalt bedrock.

Soil 38 is a very deep, slightly plastic soil derived from alluvium. Surface soils are moderately thick generally silt loams. Subsoils are generally very thick, gravelly to very gravelly silt loams or clay loams. This soil is well drained. Permeability is moderately rapid.

Bedrock is composed of hard, highly fractured basalt. Depth to bedrock is greater than 48 inches.

Range of Profile Characteristics of Soil 38

Litter:	Leaves and decomposing organic matter. 0 to ¼ inch thick.
Surface Layers:	Grayish brown to brown silt loam to loam; weak, fine to moderate, granular structure; 0 to 15 percent subangular gravel by volume; slightly sticky, slightly plastic; pH ranges from 6.5 to 7.5; 12 to 18 inches thick.
Subsoil Layers:	White to grayish brown, gravelly to very gravelly clay loam to silt; massive or weak to moderate, fine to moderate subangular blocky structure; 40 to 60 percent subrounded or subangular gravel and cobbles by volume; slightly sticky, slightly plastic; pH ranges from 6.5 to 8.0; greater than 36 inches thick.

MAPPING UNIT 40

Landtype 40 occurs on U-shaped valley bottoms or cirque basins with gentle slopes of less than 35 percent. This landtype ranges in elevation from 5000 to 6500 feet and supports an upper forest association 1/ or lodgepole pine stands.

Mapping Unit 40 consists dominantly of landtype 40 and minor amounts of landtype 41 which occurs on steep slopes and landtype 42 which occurs at lower elevations and supports an associated species stand.

Soil 40 is a very deep, nonplastic soil derived from aeolian deposits and/or glacial drift and outwash materials of granodioritic origin. Surface soils are generally thin to moderately thick silt loam ash deposits. Locally, ash is absent and the surface soils are gravelly, sandy loams or loamy sands. Buried soils or subsoils are very thick, noncompact to weakly compact, very gravelly and cobbly sands, loamy sands or sandy loams. This soil is well drained. Permeability is rapid.

Bedrock is generally greater than 144 inches deep.

Range of Profile Characteristics of Soil 40

Litter:	Needles, leaves, twigs and decomposing organic matter. ½ to 1½ inches thick.
Surface Layers: 2/	Dark yellowish brown to dark brown, nongravelly to gravelly silt loam; single grained or weak, fine, subangular blocky structure; 0 to 40 percent rounded gravel and cobbles by volume; nonsticky, nonplastic; pH ranges from 5.5 to 6.5; 6 to 24 inches thick.
Buried Layers:	Dark brown to dark yellowish brown, very gravelly and cobbly, sand to sandy loam; single grained or massive; 55 to 80 percent rounded gravel, cobbles and stones by volume; nonsticky, nonplastic; pH ranges from 5.5 to 6.5; greater than 100 inches thick.

1/ A predominance of Engelmann spruce and subalpine fir with lodgepole pine, western larch and white fir occurring to a lesser extent.

2/ Locally, ash is absent. Surface soils are most commonly gravelly sandy loams to loamy sands under these conditions.

MAPPING UNIT 41

Landtype 41 occurs on steep (greater than 35 percent) sideslopes of U-shaped glacial valleys. This landtype ranges in elevation from 5200 to 6800 feet and supports an upper forest association 1/ or lodgepole pine stands.

Mapping Unit 41 consists dominantly of landtype 41 and minor amounts of landtype 40 which occurs on gentle slopes and landtype 43 which occurs at lower elevations and supports an associated species stand.

Soil 41 is a very deep, nonplastic soil derived from aeolian deposits and/or glacial drift materials of granodioritic origin. Surface soils are generally thin silt loam ash deposits. Locally, ash is absent and the surface soils are gravelly silt loams, sandy loams or loamy sands. Buried soils or subsoils are very thick, noncompact to weakly compact, very gravelly and cobbly sands, loamy sands or sandy loams. This soil is well drained. Permeability is rapid.

Bedrock is generally greater than 144 inches deep.

Range of Profile Characteristics of Soil 41

Litter:	Needles, leaves, twigs and decomposing organic matter. ½ to 1½ inches thick.
Surface Layers: 2/	Dark yellowish brown to dark brown, nongravelly to gravelly silt loam; single grained or weak, fine, subangular blocky structure; 0 to 40 percent rounded gravel and cobbles by volume; nonsticky, nonplastic; pH ranges from 5.5 to 6.5; 4 to 18 inches thick.
Buried Layers:	Dark brown to dark yellowish brown, very gravelly and cobbly, sand to sandy loam; single grained or massive; 55 to 80 percent rounded gravel, cobbles and stones by volume; nonsticky, nonplastic; pH ranges from 5.5 to 6.5; greater than 100 inches thick.

1/ A predominance of Engelmann spruce and subalpine fir with lodgepole pine, western larch and white fir occurring to a lesser extent.

2/ Locally, ash is absent. Surface soils are most commonly gravelly silt loams to loamy sands under these conditions.

MAPPING UNIT 42

Landtype 42 occurs on U-shaped valley bottoms with gentle slopes of less than 35 percent. This landtype ranges in elevation from 4200 to 5400 feet and supports an associated species stand 1/ or locally ponderosa pine stands.

Mapping Unit 42 consists dominantly of landtype 42 and minor amounts of landtype 43 which occurs on steep slopes and landtype 40 which occurs at higher elevations and supports an upper forest association or lodgepole pine stands.

Soil 42 is a very deep, nonplastic soil derived from aeolian deposits and/or glacial drift and outwash materials or granodioritic origin. Surface soils are generally thin to moderately thick silt loam ash deposits. Locally, ash is absent and the surface soils are gravelly loamy sand or sandy loams. Buried soils or subsoils are very thick, noncompact to weakly compact, very gravelly and cobbly sands, loamy sands or sandy loams. This soil is well drained. Permeability is rapid.

Bedrock is generally greater than 144 inches deep.

Range of Profile Characteristics of Soil 42

Litter:	Needles, leaves, twigs and decomposing organic matter. ½ to 1½ inches thick.
Surface Layers: 2/	Dark yellowish brown to dark brown, nongravelly to gravelly, silt loam; single grained or weak, fine, subangular blocky structure; 0 to 45 percent rounded gravel and cobbles by volume; nonsticky, nonplastic; pH ranges from 5.5 to 7.0; 4 to 18 inches thick.
Buried Layers:	Dark brown to dark yellowish brown, very gravelly and cobbly loamy sand to sandy loam; single grained or massive; 50 to 80 percent rounded gravel, cobbles and stones by volume; nonsticky, nonplastic; pH ranges from 5.5 to 6.5; greater than 100 inches thick.

1/ A predominance of white fir, western larch and Douglas-fir with lodgepole pine, ponderosa pine and Engelmann spruce occurring to a lesser extent.

2/ Locally, ash is absent. Surface soils are most commonly gravelly silt loam to loamy sands under these situations.

MAPPING UNIT 43

Landtype 43 occurs on steep (greater than 35 percent) sideslopes of U-shaped glacial valleys. This landtype ranges in elevation from 4200 to 5400 feet and supports an associated species stand 1/ or locally ponderosa pine stands.

Mapping Unit 43 consists dominantly of landtype 43 and minor amounts of landtype 42 which occurs on gentle slopes and landtype 41 which occurs at higher elevations and supports an upper forest association or lodgepole pine stands.

Soil 43 is a very deep, nonplastic soil derived from aeolian deposits and/or glacial drift materials of granodioritic origin. Surface soils are generally thin silt loam ash deposits. Locally, ash is absent and the surface soils are gravelly sandy loams or loamy sands. Buried soils or subsoils are very thick, noncompact to weakly compact, very gravelly and cobbly sands, loamy sands or sandy loams. This soil is well drained. Permeability is rapid.

Bedrock is generally greater than 144 inches deep.

Range of Profile Characteristics of Soil 43

Litter:	Needles, leaves, twigs and decomposing organic matter. ½ to 1½ inches thick.
Surface Layers: 2/	Dark yellowish brown to dark brown, nongravelly to gravelly, silt loam; single grained or weak, fine, subangular blocky structure; 0 to 45 percent rounded gravel by volume; nonsticky, nonplastic; pH ranges from 5.5 to 7.0; 4 to 18 inches thick.
Buried Layers:	Dark brown to dark yellowish brown, very gravelly loamy sand to sandy loam; single grained or massive, noncompact to weakly compact; 50 to 80 percent rounded gravel, cobbles and stones by volume; nonsticky, nonplastic; pH ranges from 5.5 to 6.5; greater than 100 inches thick.

1/ A predominance of white fir, western larch and Douglas-fir with lodgepole pine and ponderosa pine occurring to a lesser extent.

2/ Locally, ash is absent. Surface soils are most commonly gravelly silt loam to loamy sands under these conditions.

MAPPING UNIT 44

Landtype 44 occurs on U-shaped valley bottoms or cirque basins with gentle slopes of less than 35 percent. This landtype ranges in elevation from 5600 to 6800 feet and supports an upper forest association 1/ or lodgepole pine stands.

Mapping Unit 44 consists dominantly of landtype 44 and minor amounts of landtype 45 which occurs on steep slopes and landtype 46 which occurs at lower elevations and supports an associated species stand.

Soil 44 is a very deep, nonplastic to slightly plastic soil derived from aeolian deposits and/or glacial drift and outwash materials of generally metasedimentary or sedimentary bedrock origin. Surface soils are generally thin silt loam ash deposits. Locally, ash is absent and the surface soils are sandy loams or loams. Buried soils or subsoils are very thick, noncompact to weakly compact, gravelly to very gravelly, sandy loams, loams or sandy clay loams. This soil is well drained. Permeability is rapid.

Bedrock is generally greater than 144 inches deep.

Range of Profile Characteristics of Soil 44

Litter:	Needles, leaves, twigs and decomposing organic matter. ½ to 1½ inches thick.
Surface Layers: 2/	Dark yellowish brown to dark brown, silt loam; single grained to weak, fine, subangular blocky structure; 0 to 10 percent subangular or subrounded gravel and cobbles by volume; nonsticky, nonplastic; pH ranges from 5.5 to 7.0; 4 to 18 inches thick.
Buried Layers:	Dark brown to yellowish red, gravelly to very gravelly and cobbly sandy loam to sandy clay loam; massive; 40 to 80 percent subangular, subrounded or rounded gravel, cobbles and stones by volume; nonsticky to slightly sticky, nonplastic to slightly plastic; pH ranges from 5.5 to 7.0; greater than 100 inches thick.

1/ A predominance of Engelmann spruce and subalpine fir with lodgepole pine, western larch and white fir occurring to a lesser extent.

2/ Locally, ash is absent. Surface soils are most commonly sandy loam to loam under these conditions.

MAPPING UNIT 45

Landtype 45 occurs on steep (greater than 35 percent) sideslopes of U-shaped glacial valleys. This landtype ranges in elevation from 5600 to 6900 feet and supports an upper forest association 1/ or lodgepole pine stands.

Mapping Unit 45 consists dominantly of landtype 45 and minor amounts of landtype 44 which occurs on gentle slopes and landtype 47 which occurs at lower elevations and supports an associated species stand.

Soil 45 is a very deep, nonplastic to slightly plastic soil derived from aeolian deposits and/or glacial drift materials of generally metasedimentary or sedimentary bedrock origin. Surface soils are generally thin silt loam ash deposits. Locally, ash is absent and the surface soils are sandy loams or loams. Buried soils or subsoils are very thick, noncompact to weakly compact, gravelly to very gravelly, sandy loams, loams or sandy clay loams. This soil is well drained. Permeability is rapid.

Bedrock is generally greater than 144 inches deep.

Range of Profile Characteristics of Soil 45

Litter:	Needles, leaves, twigs and decomposing organic matter. ½ to 1½ inches thick.
Surface Layers: 2/	Dark yellowish brown to dark brown silt loam; single grained to weak, fine, subangular blocky structure; 0 to 10 percent subangular or subrounded gravel and cobbles by volume; nonsticky, nonplastic; pH ranges from 5.5 to 7.0; 4 to 18 inches thick.
Buried Layers:	Dark brown to yellowish red, gravelly to very gravelly and cobbly sandy loam to sandy clay loam; massive; 40 to 80 percent subangular, subrounded or rounded gravel, cobbles and stones by volume; nonsticky to slightly sticky, nonplastic to slightly plastic; pH ranges from 5.5 to 7.0; greater than 100 inches thick.

1/ A predominance of Engelmann spruce and subalpine fir with lodgepole pine, western larch and white fir occurring to a lesser extent.

2/ Locally, ash is absent. Surface soils are most commonly sandy loam to loam under these conditions.

MAPPING UNIT 46

Landtype 46 occurs on U-shaped valley bottoms with gentle slopes of less than 35 percent. This landtype ranges in elevation from 4100 to 5600 feet and supports an associated species stand 1/ or locally ponderosa pine stands.

Mapping Unit 46 consists dominantly of landtype 46 and minor amounts of landtype 47 which occurs on steep slopes and landtype 44 which occurs at higher elevations and supports an upper forest association or lodgepole pine stands.

Soil 46 is a very deep, nonplastic to slightly plastic soil derived from aeolian deposits and/or glacial drift and outwash materials of generally metasedimentary or sedimentary bedrock origin. Surface soils are generally thin silt loam ash deposits. Locally, ash is absent and the surface soils are silt loams or loams. Buried soils or subsoils are very thick, noncompact to weakly compact, gravelly to very gravelly, loamy sands, sandy loams or loams. This soil is well drained. Permeability is rapid.

Bedrock is generally greater than 144 inches deep.

Range of Profile Characteristics of Soil 46

Litter:	Needles, leaves, twigs and decomposing organic matter. ½ to 1½ inches thick.
Surface Layers: 2/	Dark yellowish brown to dark brown silt loam; single grained to weak, fine, subangular blocky structure; 0 to 10 percent subangular or subrounded gravel and cobbles by volume; nonsticky, nonplastic; pH ranges from 5.5 to 7.0; 4 to 18 inches thick.
Buried Layers:	Dark brown to reddish brown, gravelly to very gravelly and cobbly, loamy sand to loam; single grained or massive; 40 to 80 percent subangular, subrounded or rounded gravel, cobbles and stones by volume; nonsticky to slightly sticky, nonplastic to slightly plastic; pH ranges from 5.5 to 7.0; greater than 100 inches thick.

1/ A predominance of white fir, western larch and Douglas-fir with ponderosa pine occurring to a lesser extent.

2/ Locally, ash is absent. Surface soils are most commonly loam to silt loam under these conditions.

MAPPING UNIT 47

Landtype 47 occurs on steep (greater than 35 percent) sideslopes of U-shaped glacial valleys. This landtype ranges in elevation from 4100 to 5600 feet and supports an associated species stand 1/ or locally ponderosa pine stands.

Mapping Unit 47 consists dominantly of landtype 47 and minor amounts of landtype 46 which occurs on gentle slopes and landtype 45 which occurs at higher elevations and supports an upper forest association or lodgepole pine stands.

Soil 47 is a very deep, nonplastic to slightly plastic soil derived from aeolian deposits and/or glacial drift materials of generally metasedimentary or sedimentary bedrock origin. Surface soils are generally thin silt loam ash deposits. Locally, ash is absent and the surface soils are silt loams or loams. Buried soils or subsoils are very thick, noncompact to weakly compact, gravelly to very gravelly, loamy sands, sandy loams or loams. This soil is well drained. Permeability is rapid.

Bedrock is generally greater than 144 inches deep.

Range of Profile Characteristics of Soil 47

Litter:	Needles, leaves, twigs and decomposing organic matter. ½ to 1½ inches thick.
Surface Layers: 2/	Dark yellowish brown to dark brown silt loam; single grained to weak, fine, subangular blocky structure; 0 to 10 percent subangular or subrounded gravel and cobbles by volume; nonsticky, nonplastic; pH ranges from 5.5 to 7.0; 4 to 18 inches thick.
Buried Layers:	Dark brown to reddish brown, gravelly to very gravelly and cobbly, loamy sand to loam; single grained or massive; 40 to 80 percent subangular, subrounded or rounded gravel, cobbles and stones by volume; nonsticky to slightly sticky, nonplastic to slightly plastic; pH ranges from 5.5 to 7.0; greater than 100 inches thick.

1/ A predominance of white fir, western larch and Douglas-fir with ponderosa pine occurring to a lesser extent.

2/ Locally, ash is absent. Surface soils are most commonly loam to silt loam under these conditions.

MAPPING UNIT 50

Mapping Unit 50 consists primarily of pyroclastic rock outcrops with inclusions of soil. The most common inclusions are Landtypes 5, 51, 52, 53, 54, 61, 62, 63, 81, 82, 87 and 100.

The pyroclastic rock outcrop is composed primarily of tuffs, volcanic sediments (breccias or conglomerates) and some greenstone. These rocks range from hard to moderately hard and competent to moderately competent.

This mapping unit occurs on ridgecrests and sideslopes.

MAPPING UNIT 51

Landtype 51 occurs on steep, nondissected to slightly dissected sideslopes of greater than 35 percent with northerly aspects. This landtype ranges in elevation from 3500 to 6300 feet and supports an associated species stand 1/.

Mapping Unit 51 consists dominantly of landtype 51 and minor amounts of landtype 52 which is highly dissected, landtype 53 which occurs on slopes with southerly aspects and supports ponderosa pine stands, and landtype 55 which occurs on gentle slopes.

Soil 51 is a shallow to moderately deep, nonplastic soil derived from colluvium and residuum. Surface soils are generally very thin to thin, non-gravelly to gravelly, sandy loams, loams or silt loams. Locally, surface soils will be of silt loam ash deposits. Subsoils and buried soils are generally thin, gravelly to very gravelly, loamy sands, sandy loams, or loams. This soil is well drained. Permeability is rapid.

Bedrock is composed of moderately competent, moderately hard to hard, whitish pink to gray, rhyolite rock. Depth to bedrock ranges from 16 to 40 inches.

Range of Profile Characteristics of Soil 51

Litter:	Needles, leaves, twigs and decomposing organic matter. 1 to 2 inches thick.
Surface Layers: 2/	Brown to dark grayish brown, nongravelly to gravelly, sandy loam to silt loam; weak, fine, subangular blocky structure; 5 to 40 percent subangular and angular gravel by volume; nonsticky, nonplastic; pH ranges from 6.0 to 6.5; 5 to 16 inches thick.
Subsoil Layers:	Grayish brown to dark yellowish brown, gravelly to very gravelly, loamy sand to loam; massive or single grained; 40 to 65 percent subangular and angular gravel, cobbles and stones by volume; nonsticky, nonplastic; pH ranges from 5.0 to 6.5; 10 to 35 inches thick.

1/ A predominance of white fir, Douglas-fir and western larch with ponderosa pine or lodgepole pine sometimes common.

2/ Locally, silt loam ash may be present to a thickness of 16 inches.

MAPPING UNIT 52

Landtype 52 occurs on steep, highly dissected sideslopes of greater than 35 percent with northerly aspects. This landtype ranges in elevation from 3500 to 6300 feet and supports an associated species stand 1/.

Mapping Unit 52 consists dominantly of landtype 52 and minor amounts of landtype 51 which is nondissected to slightly dissected and landtype 54 which occurs on slopes with southerly aspects and supports ponderosa pine stands.

Soil 52 is a shallow to moderately deep, nonplastic soil derived from colluvium and residuum. Surface soils are generally very thin to thin, nongravelly to gravelly, sandy loams, loams or silt loams. Locally surface soils will be of silt loam ash deposits. Subsoils and buried soils are generally thin, gravelly to very gravelly, loamy sands, sandy loams, or loams. This soil is well drained. Permeability is rapid.

Bedrock is composed of moderately competent, moderately hard to hard, whitish pink to gray, rhyolite rock. Depth to bedrock ranges from 5 to 32 inches.

Range of Profile Characteristics of Soil 52

Litter:	Needles, leaves, twigs and decomposing organic matter. 1 to 2 inches thick.
Surface Layers: 2/	Brown to dark grayish brown, nongravelly to gravelly, sandy loam to silt loam; weak, fine subangular blocky structure; 5 to 40 percent subangular and angular gravel by volume; nonsticky, nonplastic; pH ranges from 6.0 to 6.5; 5 to 15 inches thick.
Subsoil Layers:	Grayish brown to dark yellowish brown, gravelly to very gravelly, loamy sand to loam; massive or single grained; 40 to 65 percent subangular and angular gravel, cobbles and stones by volume; nonsticky, nonplastic; pH ranges from 5.0 to 6.5; 10 to 35 inches thick.

1/ A predominance of white fir, Douglas-fir and western larch with ponderosa pine or lodgepole pine sometimes common.

2/ Locally, ash may be present to a thickness of 15 inches.

MAPPING UNIT 53

Landtype 53 occurs on steep, nondissected to slightly dissected sideslopes of greater than 35 percent with southerly aspects. This landtype ranges in elevation from 3500 to 5500 feet and supports primarily ponderosa pine with some Douglas-fir and western larch.

Mapping Unit 53 consists dominantly of landtype 53 and minor amounts of landtype 54 which is highly dissected, landtype 51 which occurs on slopes with northerly aspects and supports an associated species stand and landtype 56 which occurs on gentle slopes.

Soil 53 is a shallow to moderately deep, nonplastic soil derived from colluvium and residuum. Surface soils are generally very thin to thin, nongravelly to gravelly, loams or sandy loams. Subsoils are thin, gravelly to very gravelly, loamy sands or sandy loams. This soil is well drained. Permeability is rapid.

Bedrock is composed of moderately competent, moderately hard to hard, whitish pink to gray, rhyolite rock. Depth to bedrock ranges from 15 to 40 inches.

Range of Profile Characteristics of Soil 53

Litter:	Needles, leaves, twigs and decomposing organic matter. 0 to 1 inch thick.
Surface Layers:	Brown to dark grayish brown, nongravelly to gravelly, sandy loam to loam; weak, fine subangular blocky structure; 35 to 50 percent subangular and angular gravel by volume; nonsticky, nonplastic; pH ranges from 5.5 to 6.5; 5 to 18 inches thick.
Subsoil Layers:	Grayish brown to dark yellowish brown, gravelly to very gravelly (locally extremely gravelly), loamy sand to sandy loam; 40 to 75 percent subangular and angular gravel, cobbles and stones by volume; nonsticky, nonplastic; pH ranges from 5.0 to 6.5; 10 to 35 inches thick.

MAPPING UNIT 54

Landtype 54 occurs on steep, dissected sideslopes of greater than 35 percent with southerly aspects. This landtype ranges in elevation from 3500 to 5500 feet and supports primarily ponderosa pine with some Douglas-fir and western larch.

Mapping Unit 54 consists dominantly of landtype 54 and minor amounts of landtype 53 which is nondissected to slightly dissected and landtype 52 which occurs on slopes with northerly aspects and supports an associated species stand.

Soil 54 is a shallow to moderately deep, nonplastic soil derived from colluvium and residuum. Surface soils are generally very thin to thin, nongravelly to gravelly, loams or sandy loams. Subsoils are thin, gravelly to very gravelly, loamy sands, sandy loams or loams. This soil is well drained. Permeability is rapid.

Bedrock is composed of moderately competent, moderately hard to hard, whitish pink to gray, rhyolite rock. Depth to bedrock ranges from 15 to 40 inches.

Range of Profile Characteristics of Soil 54

Litter:	Needles, leaves, twigs and decomposing organic matter. 0 to 1 inch thick.
Surface Layers:	Brown to dark grayish brown, nongravelly to gravelly, sandy loam to loam; weak, fine subangular blocky structure; 35 to 50 percent subangular and angular gravel by volume; nonsticky, nonplastic; pH ranges from 5.5 to 6.5; 5 to 18 inches thick.
Subsoil Layers:	Grayish brown to dark yellowish brown, gravelly to very gravelly (locally extremely gravelly), loamy sand to sandy loam; 40 to 75 percent subangular and angular gravel, cobbles and stones by volume; nonsticky, nonplastic; pH ranges from 5.0 to 6.5; 10 to 35 inches thick.

MAPPING UNIT 55

Landtype 55 occurs on gentle ridgetops, benches or toeslopes of less than 35 percent. This landtype ranges in elevation from 3500 to 6000 feet and supports associated species stands 1/.

Mapping Unit 55 consists dominantly of landtype 55 and minor amounts of landtype 51 which occurs on steep slopes and landtype 56 which is more droughty and supports predominantly ponderosa pine.

Soil 55 is a shallow to moderately deep, nonplastic soil derived from aeolian deposits and buried residuum. Surface soils are generally thin silt loam ash deposits. Locally ash is absent and surface soils are loams. Buried soils are thin, gravelly to very gravelly, loamy sands or sandy loams. This soil is well drained. Permeability is rapid.

Bedrock is composed of moderately competent, moderately hard to hard, whitish pink to gray, rhyolite rock. Depth to bedrock ranges from 15 to 40 inches.

Range of Profile Characteristics of Soil 55

Litter:	Needles, leaves, twigs and decomposing organic matter. ½ to 2 inches thick.
Surface Layers: 2/	Light brown to light yellowish brown, nongravelly silt loam; single grained or weak, fine subangular blocky structure; 0 to 10 percent subangular gravel by volume; nonsticky, nonplastic; pH ranges from 6.0 to 6.5; 5 to 18 inches thick.
Buried Layers:	Grayish brown to light yellowish brown, gravelly to very gravelly, sandy loam to loamy sand; 40 to 75 percent subangular and angular gravel, cobbles and stones by volume; nonsticky, nonplastic; pH ranges from 5.0 to 6.5; 22 to 35 inches thick.

1/ A predominance of white fir, Douglas-fir and western larch with ponderosa pine or lodgepole pine sometimes common.

2/ Locally, ash is absent. Surface soils are most commonly loam under these situations.

MAPPING UNIT 56

Landtype 56 occurs on gentle slopes, ridgetops or benches of less than 35 percent slope generally with southerly aspects. This landtype ranges in elevation from 3500 to 5200 feet and supports ponderosa pine with some Douglas-fir and western larch.

Mapping Unit 56 consists dominantly of landtype 56 and minor amounts of landtype 55 which supports associated species stands and landtype 53 which occurs on steep slopes.

Soil 56 is a shallow to moderately deep, nonplastic soil derived from residuum. Surface soils are generally very thin to thin, nongravelly to gravelly, loams or silt loams. Subsoils are thin, gravelly to very gravelly, loamy sands or sandy loams. This soil is well drained. Permeability is rapid.

Bedrock is composed of moderately competent, moderately hard to hard, whitish pink to gray, rhyolite rock. Depth to bedrock ranges from 15 to 40 inches.

Range of Profile Characteristics of Soil 56

Litter:	Needles, leaves, twigs and decomposing organic matter. 0 to 1 inch thick.
Surface Layers:	Reddish gray to light brown, nongravelly to gravelly, sandy loam to silt loam; weak, fine subangular blocky structure; 5 to 50 percent subangular and angular gravel by volume; nonsticky to slightly sticky, nonplastic to slightly plastic; pH ranges from 5.0 to 6.5; 5 to 20 inches thick.
Subsoil Layers:	Grayish brown to dark yellowish brown, gravelly to very gravelly (locally extremely gravelly), loamy sand to sandy loam; massive or single grained; 40 to 75 percent subangular and angular gravel, cobbles and stones by volume; nonsticky, nonplastic; pH ranges from 5.0 to 6.5; 20 to 35 inches thick.

MAPPING UNIT 57

Landtype 57 occurs on steep, nondissected to slightly dissected slopes of greater than 35 percent. This landtype ranges in elevation from 3500 to 5000 feet and supports scattered ponderosa pine with a few Douglas-fir.

Mapping Unit 57 consists dominantly of landtype 57 and minor amounts of landtype 53 which occurs over rock which has less fracturing.

Soil 57 is a deep to very deep nonplastic soil derived from colluvium. Surface soils are generally very thin to thin, gravelly to very gravelly loams or sandy loams. Subsoils are generally thick, very gravelly to extremely gravelly loamy sands. This soil is well drained. Permeability is rapid.

Bedrock is composed of moderately competent, moderately hard, very highly fractured, whitish pink to gray, rhyolite rock. Depth to bedrock ranges from 60 to 90 inches.

Range of Profile Characteristics of Soil 57

Litter:	Needles, leaves, twigs and decomposing organic matter. 0 to 1 inch thick.
Surface Layers:	Dark brown to light brown, gravelly to very gravelly, loam to silt loam; single grained or weak, fine subangular blocky structure; 35 to 60 percent angular gravel by volume, nonsticky to slightly sticky, nonplastic; pH ranges from 5.0 to 6.5; 5 to 24 inches thick.
Subsoil Layers:	Strong brown to dark yellowish brown, extremely gravelly to very gravelly, loamy sand; 50 to 95 percent angular gravel and cobbles by volume; nonsticky, nonplastic; pH ranges from 5.0 to 6.5; 36 to 85 inches thick.

MAPPING UNIT 58

Landtype 58 occurs on slightly dissected sideslopes and toeslopes of between 25 and 50 percent. This landtype ranges in elevation from 3900 to 4600 feet and supports sparce ground cover with a scattered ponderosa pine overstory.

Mapping Unit 58 consists dominantly of landtype 58 and minor amounts of landtype 53 which supports a better vegetative cover and is derived from rhyolite bedrock.

Soil 58 is a very shallow to shallow, nonplastic soil derived from residuum and colluvium. Surface soils are very thin, sandy loams. Subsoils are thin, fine loamy sands or fine sands. This soil is well drained. Permeability is rapid.

Bedrock is composed of incompetent, soft, white to whitish pink, vitric tuff. Depth to bedrock ranges from 5 to 24 inches.

Range of Profile Characteristics of Soil 58

Litter:	Needles, leaves and twigs. 0 to ½ inch thick.
Surface Layers:	Very dark gray to gray, nongravelly, fine sandy loam to loamy fine sand; single grained or weak, fine, subangular structure; 0 to 20 percent angular gravel by volume; nonsticky, nonplastic; pH ranges from 6.0 to 6.5; 2 to 6 inches thick.
Subsoil Layers:	Very dark gray to gray, nongravelly, fine sand to loamy fine sand; single grained; 5 to 25 percent angular gravel by volume; nonsticky, nonplastic; pH ranges from 6.0 to 7.0; 3 to 22 inches thick.

MAPPING UNIT 61

Landtype 61 occurs on steep, nondissected to slightly dissected sideslopes of greater than 35 percent. This landtype ranges in elevation from 5500 to 6800 feet and supports an upper forest association 1/.

Mapping Unit 61 consists dominantly of landtype 61 and minor amounts of landtype 62 which supports lodgepole pine, landtype 63 which supports an associated species stand and landtype 71 which occurs on gentle slopes.

Soil 61 is a moderately deep to deep, nonplastic to slightly plastic soil derived from aeolian deposits overlying buried colluvium and residuum. Surface soils are thin, silt loam ash deposits. Buried soils are generally thin to moderately thick, nongravelly to gravelly, sandy loams, loams or silt loams. This soil is well drained. Permeability is rapid.

Bedrock is composed of moderately competent, moderately hard (locally soft) pyroclastic rock with local inclusions of hard basalt or andesite. Depth to bedrock ranges from 20 to 60 inches.

Range of Profile Characteristics of Soil 61

Litter:	Needles, leaves, twigs and decomposing organic matter. ½ to 2 inches thick.
Surface Layers:	Light yellowish brown to brown, silt loam; single grained or weak, fine subangular blocky structure; 0 to 15 percent subangular gravel by volume; nonsticky, nonplastic; pH ranges from 6.0 to 6.5; 4 to 20 inches thick.
Buried Layers:	Yellowish to reddish brown, nongravelly to gravelly, sandy loam to silt loam; massive or weak, fine subangular blocky structure; subangular or subrounded gravel and cobbles by volume; nonsticky to slightly sticky, nonplastic to slightly plastic; pH ranges from 5.0 to 6.5; 10 to 56 inches thick.

1/ A predominance of Subalpine fir and Engelmann spruce with lodgepole pine, white fir and western larch sometimes common.

MAPPING UNIT 62

Landtype 62 occurs on steep, nondissected to slightly dissected sideslopes of greater than 35 percent. This landtype ranges in elevation from 4200 to 6700 feet and supports lodgepole pine stands.

Mapping Unit 62 consists dominantly of landtype 62 and minor amounts of landtype 61 which supports an upper forest association, landtype 63 which supports an associated species stand and landtype 72 which occurs on gentle slopes.

Soil 62 is a moderately deep to deep, nonplastic to slightly plastic soil derived from aeolian deposits overlying buried colluvium and residuum. Surface soils are thin silt loam ash deposits. Buried soils are generally thin to moderately thick, nongravelly to gravelly, sandy loams, loams or silt loams. This soil is well drained. Permeability is rapid.

Bedrock is composed of moderately competent, moderately hard (locally soft) pyroclastic rock with local inclusions of hard basalt or andesite. Depth to bedrock ranges from 20 to 60 inches.

Range of Profile Characteristics of Soil 62

Litter:	Needles, leaves, twigs and decomposing organic matter. ½ to 2 inches thick.
Surface Layers:	Light yellowish brown to brown, silt loam; single grained to weak, fine subangular blocky structure; 0 to 15 percent subangular gravel by volume; nonsticky, nonplastic; pH ranges from 6.0 to 7.0; 4 to 20 inches thick.
Buried Layers:	Dark brown to reddish brown, nongravelly to gravelly, sandy loam to silt loam; massive or weak, fine subangular blocky structure; 10 to 50 percent subangular or subrounded gravel and cobbles by volume; nonsticky to slightly sticky, nonplastic to slightly plastic; pH ranges from 5.0 to 6.5; 10 to 56 inches thick.

MAPPING UNIT 63

Landtype 63 occurs on steep, nondissected to slightly dissected sideslopes of greater than 35 percent. This landtype ranges in elevation from 3200 to 6200 feet and supports an associated species stand 1/.

Mapping Unit 63 consists dominantly of landtype 63 and minor amounts of landtype 61 which supports an upper forest association, landtype 62 which supports lodgepole pine, landtype 64 which supports ponderosa pine, landtype 73 which occurs on gentle slopes and landtype 81 on which ash is absent or less than 4 inches thick.

Soil 63 is a moderately deep to deep, nonplastic to slightly plastic soil derived from aeolian deposits overlying buried colluvium and residuum. Surface soils are thin silt loam ash deposits. Buried soils are generally thin to moderately thick, nongravelly to gravelly, sandy loams, loams or silt loams. This soil is well drained. Permeability is rapid.

Bedrock is composed of moderately competent, moderately hard (locally soft) pyroclastic rock with local inclusions of hard basalt or andesite. Depth to bedrock ranges from 20 to 60 inches.

Range of Profile Characteristics of Soil 63

Litter:	Needles, leaves, twigs and decomposing organic matter. ½ to 2 inches thick.
Surface Layers:	Light yellowish brown to brown, silt loam; single grained or weak, fine subangular blocky structure; 0 to 15 percent subangular gravel by volume; nonsticky, nonplastic; pH ranges from 6.0 to 7.0; 4 to 20 inches thick.
Buried Layers:	Dark brown to reddish brown, nongravelly to gravelly, sandy loam to silt loam; massive, single grained or weak, fine subangular blocky structure; 10 to 50 percent subangular or subrounded gravel and cobbles by volume; nonsticky to slightly sticky, nonplastic to slightly plastic; pH ranges from 5.0 to 6.5; 10 to 56 inches thick.

1/ A predominance of white fir, Douglas-fir and western larch with ponderosa pine or lodgepole pine sometimes common.

MAPPING UNIT 64

Landtype 64 occurs on steep, nondissected to slightly dissected sideslopes of greater than 35 percent. This landtype ranges in elevation from 3000 to 5000 feet and supports ponderosa pine stands or ponderosa pine/Douglas-fir stands.

Mapping Unit 64 consists dominantly of landtype 64 and minor amounts of landtype 63 which supports an associated species, landtype 75 which occurs on gentle slopes and landtype 82 on which ash is absent or less than 4 inches thick.

Soil 64 is a shallow to moderately deep, nonplastic to slightly plastic soil derived from aeolian deposits overlying buried colluvium and residuum. Surface soils are thin silt loam ash deposits. Buried soils are generally thin to moderately thick, nongravelly to gravelly, sandy loams or loams. This soil is well drained. Permeability is rapid.

Bedrock is composed of moderately competent, moderately hard (locally soft) pyroclastic rock with local inclusions of hard basalt or andesite. Depth to bedrock ranges from 10 to 36 inches.

Range of Profile Characteristics of Soil 64

Litter:	Needles, leaves, twigs and decomposing organic matter. 0 to 1 inch thick.
Surface Layers:	Light yellowish brown to dark brown silt loam; single grained or weak, fine subangular blocky structure; 0 to 10 percent subangular or subrounded gravel by volume; nonsticky, nonplastic; pH ranges from 6.0 to 7.0; 4 to 20 inches thick.
Buried Layers:	Dark yellowish brown to brown, nongravelly to gravelly, sandy loam to silt loam; massive or single grained; 5 to 45 percent subangular or subrounded gravel and cobbles by volume; nonsticky to slightly sticky, nonplastic to slightly plastic; pH ranges from 5.5 to 6.5; 6 to 32 inches thick.

MAPPING UNIT 65

Landtype 65 occurs on steep, nondissected to slightly dissected sideslopes of greater than 35 percent. This landtype ranges in elevation from 4000 to 6000 feet and supports an associated species stand 1/.

Mapping Unit 65 consists dominantly of landtype 65 and minor amounts of landtype 63 which occurs on the convex portions of the slope and landtype 86 on which ash is absent or less than 4 inches thick and the gravel content which is generally low.

Soil 65 is a deep to very deep, nonplastic to slightly plastic soil derived from aeolian deposits overlying buried residuum and colluvium. Surface soils are thin silt loam ash deposits. Buried soils are generally moderately thick to thick, nongravelly to gravelly, loams, silt loams or clay loams. This soil is well drained. Permeability is rapid in the surface soils and moderately rapid to slow in the buried soils.

Bedrock is composed of moderately competent to incompetent, moderately hard to soft, gray to reddish brown, pyroclastic rock or weathered vesicular basalt rock. Depth to bedrock ranges from 60 to 144 inches.

Range of Profile Characteristics of Soil 65

Litter:	Needles, leaves, twigs and decomposing organic matter. ½ to 2 inches thick.
Surface Layers:	Light brown to dark brown, silt loam; single grained or weak, fine subangular blocky structure; 0 to 10 percent subangular gravel by volume; nonsticky, nonplastic; pH ranges from 6.0 to 6.5; 4 to 18 inches thick.
Buried Layers:	Dark reddish gray to dark brown, nongravelly to gravelly, loam to clay loam; massive or moderate, fine, subangular blocky structure; 15 to 50 percent subangular or subrounded gravel, cobbles and stones by volume; slightly sticky to sticky, slightly plastic to plastic; pH ranges from 5.5 to 6.5; 56 to 140 inches thick.

1/ A predominance of white fir, Douglas-fir and western larch with ponderosa pine or lodgepole pine sometimes common.

MAPPING UNIT 67

Landtype 67 occurs on steep, slightly dissected to dissected sideslopes of greater than 35 percent. This landtype ranges in elevation from 3500 to 5800 feet and supports an associated species stand 1/ and local ponderosa pine/Douglas-fir stands.

Mapping Unit 67 consists dominantly of landtype 67 and minor amounts of landtype 87 on which ash is absent or less than 4 inches thick.

Soil 67 is a shallow to moderately deep, slightly plastic to plastic soil derived from aeolian deposits and buried residuum. Surface soils are thin silt loam ash depostis. Buried soils are thin to moderately thick, nongravelly to gravelly, silt loams, clay loams or silt clay loams. This soil is well drained. Permeability is rapid in the surface soils and moderately rapid in the buried soils.

Bedrock is composed of moderately competent, moderately hard to soft (locally hard) pyroclastic rock with local inclusions of basalt. Depth to bedrock ranges from 10 to 40 inches.

Range of Profile Characteristics of Soil 67

Litter:	Needles, leaves, twigs and decomposing organic matter. ½ to 2 inches thick.
Surface Layers:	Light brown to brown, silt loam; single grained to weak, fine, subangular blocky structure; 0 to 10 percent subangular gravel by volume; nonsticky, nonplastic; pH ranges from 6.0 to 6.5; 4 to 15 inches thick.
Buried Layers:	Dark grayish brown to dark brown, nongravelly to gravelly, silt loam to silty clay loam; massive or weak to moderate, fine, subangular blocky structure; 5 to 40 percent subangular or subrounded gravel and cobbles by volume; slightly sticky to sticky, slightly plastic to plastic; pH ranges from 5.0 to 6.5; 6 to 36 inches thick.

1/ A predominance of white fir, Douglas-fir and western larch with ponderosa pine or lodgepole pine sometimes common.

MAPPING UNIT 69

Landtype 69 occurs on steep, somewhat uneven, dissected sideslopes and toeslopes of greater than 35 percent. This landtype ranges in elevation from 3500 to 6000 feet and supports an associated species stand 1/ with ponderosa pine more dominant at times.

Mapping Unit 69 consists dominantly of landtype 69 and minor amounts of landtype 89 on which ash is less than 4 inches thick or absent and landtype 77 which occurs on uneven gentle slopes.

Soil 69 is a deep to very deep, plastic soil derived from aeolian deposits and buried residuum and colluvium. Surface soils are thin silt loam ash deposits. Buried soils are generally thick, nongravelly to gravelly clay loams, silty clay loams or silty clays. This soil is moderately well to imperfectly drained. Permeability is rapid in the surface soils and moderate to slow in the buried soil.

Bedrock is composed of incompetent, soft (locally saprolitic) pyrocalstic rock with local inclusions of harder pyroclastic or basalt rock. Depth to bedrock ranges from 40 to greater than 144 inches.

Range of Profile Characteristics of Soil 69

Litter:	Needles, leaves, twigs and decomposing organic matter. ½ to 2 inches thick.
Surface Layers:	Light yellowish brown to dark brown silt loam; single grained or weak, fine, subangular blocky structure; 0 to 10 percent subangular gravel by volume; nonsticky, nonplastic; pH ranges from 5.5 to 7.0; 4 to 16 inches thick.
Buried Layers:	Light yellowish brown to dark brown, nongravelly to gravelly, silt loam to clay; massive or strong, medium, subangular blocky structure; 5 to 50 percent subangular or subrounded gravel, cobbles and stones by volume; slightly sticky to very sticky, slightly plastic to very plastic; pH ranges from 5.5 to 7.0; greater than 36 inches thick.

1/ A predominance of white fir, Douglas-fir and western larch with ponderosa pine, lodgepole pine or Engelmann spruce sometimes common.

MAPPING UNIT 71

Landtype 71 occurs on gentle ridgetops and benches of less than 35 percent slope. This landtype ranges in elevation from 5500 to 6800 feet and supports an upper forest association 1/.

Mapping Unit 71 consists dominantly of landtype 71 and minor amounts of landtype 72 which supports lodgepole pine stands, landtype 73 which supports an associated species stand and landtype 61 which occurs on steep slopes.

Soil 71 is a shallow to moderately deep, nonplastic to slightly plastic soil derived from aeolian deposits and buried residuum. Surface soils are thin silt loam ash deposits. Buried soils are generally thin to moderately thick, nongravelly to gravelly, loams or sandy loams. This soil is well drained. Permeability is rapid.

Bedrock is composed of moderately competent, moderately hard, pyroclastic rock with local inclusions of hard basalt or andesite. Depth to bedrock ranges from 10 to 40 inches thick.

Range of Profile Characteristics of Soil 71

Litter:	Needles, leaves, twigs and decomposing organic matter. ½ to 2 inches thick.
Surface Layers:	Light yellowish brown to dark brown silt loam; single grained or weak, fine, subangular blocky structure; 0 to 10 percent subangular gravel by volume; nonsticky, nonplastic; pH ranges from 5.0 to 6.5; 4 to 18 inches thick.
Buried Layers:	Reddish brown to yellowish brown, nongravelly to gravelly, sandy loam to silt loam; massive or weak, fine, subangular blocky structure; 10 to 50 percent subangular or subrounded gravel, cobbles and stones by volume; nonsticky to slightly sticky, nonplastic to slightly plastic; pH ranges from 5.0 to 6.5; 6 to 36 inches thick.

1/ A predominance of Engelmann spruce and subalpine fir with lodgepole pine, western larch and white fir occurring to a lesser extent.

MAPPING UNIT 72

Landtype 72 occurs on gentle ridgetops and benches of less than 35 percent slope. This landtype ranges in elevation from 4200 to 6700 feet and supports lodgepole pine stands.

Mapping Unit 72 consists dominantly of landtype 72 and minor amounts of landtype 71 which supports an upper forest association, landtype 73 which supports an associated species stand and landtype 62 which occurs on steep slopes.

Soil 72 is a shallow to moderately deep, nonplastic to slightly plastic soil derived from aeolian deposits and buried residuum. Surface soils are thin silt loam ash deposits. Buried soils are generally thin to moderately thick, nongravelly to gravelly, loams or sandy loams. This soil is well drained. Permeability is rapid.

Bedrock is composed of moderately competent, moderately hard pyroclastic rock with local inclusions of hard basalt or andesite. Depth to bedrock ranges from 10 to 40 inches.

Range of Profile Characteristics of Soil 72

Litter:	Needles, leaves, twigs and decomposing organic matter. ½ to 2 inches thick.
Surface Layers:	Light yellowish brown to dark brown, silt loams; single grained or weak, fine, subangular blocky structure; 0 to 10 percent subangular or subrounded gravel by volume; nonsticky, nonplastic; pH ranges from 5.0 to 6.5; 4 to 18 inches thick.
Buried Layers:	Reddish brown to yellowish brown, nongravelly to gravelly, sandy loam to silt loam; massive or weak, fine, subangular blocky structure; 10 to 50 percent subangular or subrounded gravel, cobbles and stones by volume; nonsticky to slightly sticky, nonplastic to slightly plastic; pH ranges from 5.0 to 6.5; 6 to 36 inches thick.

MAPPING UNIT 73

Landtype 73 occurs on gentle ridgetops and benches of less than 35 percent slope. This landtype ranges in elevation from 3200 to 6000 feet and supports an associated species stand 1/.

Mapping Unit 73 consists dominantly of landtype 73 and minor amounts of landtype 71 which supports an upper forest association, landtype 72 which supports lodgepole pine stands, landtype 75 which supports ponderosa pine stands and landtype 63 which occurs on steep slopes.

Soil 73 is a moderately deep to deep, nonplastic to slightly plastic soil derived from aeolian deposits and buried residuum. Surface soils are thin silt loam ash deposits. Buried soils are generally thin to moderately thick, nongravelly to gravelly, sandy loams, loams or silt loams. This soil is well drained. Permeability is rapid.

Bedrock is composed of moderately competent, moderately hard to soft pyroclastic rock with local inclusions of hard basalt and andesite Depth to bedrock ranges from 20 to 60 inches.

Range of Profile Characteristics of Soil 73

Litter:	Needles, leaves, twigs and decomposing organic matter. ½ to 2 inches thick.
Surface Layers:	Light yellowish brown to dark brown, silt loam; single grained to weak, fine, subangular blocky structure; 0 to 10 percent subangular gravel by volume; nonsticky, nonplastic; pH ranges from 5.0 to 6.5; 4 to 20 inches thick.
Buried Layers:	Gray to reddish brown, nongravelly to gravelly (locally very gravelly), sandy loam to silt loam (locally loamy sand); massive or weak to moderate, fine, subangular blocky structure; 10 to 50 percent subangular or subrounded gravel, cobbles and stones by volume; nonsticky to slightly sticky, nonplastic to slightly plastic; pH ranges from 5.0 to 6.5; 16 to 56 inches thick.

1/ A predominance of white fir, Douglas-fir and western larch with ponderosa pine or lodgepole pine sometimes common.

MAPPING UNIT 75

Landtype 75 occurs on gentle ridgetops and benches of less than 35 percent slope with southerly aspects or at lower elevations. This landtype ranges in elevation from 3000 to 5000 feet and supports ponderosa pine stands.

Mapping Unit 75 consists dominantly of landtype 75 and minor amounts of landtype 73 which supports an associated species stand, landtype 72 which supports lodgepole pine stands and landtype 64 which occurs on steep slopes.

Soil 75 is a shallow to moderately deep, nonplastic to slightly plastic soil derived from aeolian deposits and buried residuum. Surface soils are thin silt loam ash deposits. Buried soils are generally thin to moderately thick, nongravelly to gravelly, loams or sandy loams. This soil is well drained. Permeability is rapid.

Bedrock is composed of moderately competent, moderately hard pyroclastic rock with local inclusions of hard basalt or andesite. Depth to bedrock ranges from 10 to 40 inches thick.

Range of Profile Characteristics of Soil 75

Litter:	Needles, leaves, twigs and decomposing organic matter. ½ to 1 inch thick.
Surface Layers:	Light yellowish brown to dark brown silt loam; single grained or weak, fine, subangular blocky structure; 0 to 10 percent subangular gravel by volume; nonsticky, nonplastic; pH ranges from 5.0 to 6.5; 4 to 15 inches thick.
Buried Layers:	Reddish brown to yellowish brown, nongravelly to gravelly, sandy loam to silt loam; massive or weak, fine, subangular blocky structure; 5 to 50 percent subangular or subrounded gravel, cobbles and stones by volume; nonsticky to slightly sticky, nonplastic to slightly plastic; pH ranges from 5.0 to 6.5; 6 to 36 inches thick.

MAPPING UNIT 76

Landtype 76 occurs on gentle, uneven and somewhat dissected toeslopes and in concave areas of less than 35 percent slope. This landtype ranges in elevation from 4000 to 6800 feet and supports lodgepole pine stands or locally an upper forest association. 1/

Mapping Unit 76 consists dominantly of landtype 76 and minor amounts of landtype 77 which supports an associated species stand.

Soil 76 is a deep to very deep, slightly plastic to plastic soil derived from aeolian deposits and buried residuum. Surface soils are thin silt loam ash deposits. Buried soils are generally moderately thick to thick, nongravelly to gravelly (locally very gravelly), silty clay loams or silty clays. This soil is moderately well to imperfectly drained. Permeability is rapid in the surface soils and moderately rapid to slow in the subsoils.

Bedrock is composed of incompetent, soft pyroclastic rock. Depth to bedrock is greater than 40 inches.

Range of Profile Characteristics of Soil 76

Litter:	Needles, leaves, twigs and decomposing organic matter. 1 to 2 inches thick.
Surface Layers:	Light yellowish brown to brown silt loam; single grained or weak, fine, subangular blocky structure; 0 to 5 percent subangular or angular gravel by volume; nonsticky, nonplastic; pH ranges from 6.0 to 7.0; 4 to 20 inches thick.
Buried Layers:	Light yellowish brown to dark olive brown, nongravelly to gravelly (locally very gravelly), silt loam to silty clay; massive or strong, medium, angular blocky structure; 5 to 50 percent subangular gravel, cobbles and stones by volume; slightly sticky to sticky, slightly plastic to plastic; pH ranges from 5.5 to 7.0; greater than 36 inches thick.

1/ A predominance of Engelmann spruce and subalpine fir with lodgepole pine, western larch and white fir occurring to a lesser extent.

MAPPING UNIT 77

Landtype 77 occurs on gentle, uneven and somewhat dissected toeslopes and in concave positions of less than 35 percent slope. This landtype ranges in elevation from 3500 to 6000 feet and supports an associated species stand 1/.

Mapping Unit 77 consists dominantly of landtype 77 and minor amounts of landtype 76 which supports lodgepole pine stands, landtype 78 which supports ponderosa pine stands, landtype 73 which occurs on convex slopes and landtype 94 on which ash is absent or less than 4 inches thick.

Soil 77 is a deep to very deep, slightly plastic to very plastic soil derived from aeolian deposits and buried residuum. Surface soils are thin silt loam ash deposits. Buried soils are generally moderately thick to thick, nongravelly to gravelly (locally very gravelly), silty clay loams or silty clays. This soil is moderately well to imperfectly drained. Permeability is rapid in the surface soils and moderately rapid to slow in the buried soils.

Bedrock is composed of incompetent, soft pyroclastic rock. Depth to bedrock ranges from 40 to greater than 144 inches.

Range of Profile Characteristics of Soil 77

Litter:	Needles, leaves, twigs and decomposing organic matter. 1 to 2 inches thick.
Surface Layers:	Light yellowish brown to brown silt loam; single grained or weak, fine, subangular blocky structure; 0 to 5 percent subangular or angular gravel by volume; nonsticky, nonplastic; pH ranges from 6.0 to 7.0; 4 to 20 inches thick.
Buried Layers:	Light yellowish brown to dark olive brown, nongravelly to gravelly (locally very gravelly), silt loam to clay; massive or strong, medium, angular blocky structure; 5 to 50 percent subangular or angular gravel, cobbles and stones by volume; sticky to very sticky, slightly plastic to very plastic; pH ranges from 5.5 to 7.0; greater than 36 inches thick.

1/ A predominance of white fir, Douglas-fir and western larch with ponderosa pine, lodgepole pine or Engelmann spruce sometimes common.

MAPPING UNIT 81

Landtype 81 occurs on steep, nondissected to slightly dissected sideslopes of greater than 35 percent. This landtype ranges in elevation from 3200 to 5800 feet and supports an associated species stand 1/.

Mapping Unit 81 consists dominantly of landtype 81 and minor amounts of landtype 82 which supports ponderosa pine stands and landtype 91 which occurs on gentle slopes.

Soil 81 is a shallow to moderately deep, nonplastic to slightly plastic soil derived from residuum and colluvium. Surface soils are generally thin, nongravelly to gravelly loams. Subsoils are generally thin to moderately thick, gravelly to very gravelly, sandy clay loams, silt loams, loams or sandy loams. This soil is well drained. Permeability is rapid.

Bedrock is composed of moderately competent to competent, moderately hard to soft (locally hard) pyroclastic rock with local inclusions of basalt and andesite. Depth to bedrock ranges from 14 to 40 inches.

Range of Profile Characteristics of Soil 81

Litter:	Needles, leaves, twigs and decomposing organic matter. ½ to 2 inches thick.
Surface Layers:	Yellowish brown to dark reddish brown, nongravelly to gravelly, loam to silt loam; weak or moderate, fine, subangular blocky or crumb structure; 5 to 40 percent subangular or angular gravel and cobbles by volume; nonsticky to slightly sticky, nonplastic to slightly plastic; pH ranges from 5.5 to 7.0; 4 to 20 inches thick.
Subsoil Layers:	Dark yellowish brown to dark brown, gravelly to very gravelly (locally extremely gravelly) loamy sand to silt loam; massive, single grained or weak, fine, subangular blicky structure; 40 to 90 percent subangular or angular gravel, cobbles and stones by volume; nonsticky to slightly sticky, nonplastic to slightly plastic; pH ranges from 5.5 to 7.0; 6 to 36 inches thick.

1/ A predominance of white fir, Douglas-fir and western larch with ponderosa pine or lodgepole pine sometimes common.

MAPPING UNIT 82

Landtype 82 occurs on steep, nondissected to slightly dissected sideslopes of greater than 35 percent. This landtype ranges in elevation from 3100 to 5600 feet and supports ponderosa pine stands.

Mapping Unit 82 consists dominantly of landtype 82 and minor amounts of landtype 81 which supports an associated species stand and landtype 92 which occurs on gentle slopes.

Soil 82 is a shallow to moderately deep, nonplastic to slightly plastic soil derived from residuum and colluvium. Surface soils are generally very thin to thin nongravelly, sandy loams, loams or silt loams. Subsoils are generally thin, nongravelly or gravelly, loamy sands, sandy loams, loams or silt loams. This soil is well drained. Permeability is rapid.

Bedrock is composed of moderately competent, moderately hard pyroclastic rock with local inclusions of basalt or andesite rock. Depth to bedrock ranges from 10 to 40 inches.

Range of Profile Characteristics of Soil 82

Litter:	Needles, leaves, twigs and decomposing organic matter. 0 to 1 inch thick.
Surface Layers:	Yellowish brown to dark reddish brown, nongravelly to gravelly, sandy loam to silt loam, single grained or weak, fine, subangular blocky structure; 5 to 40 percent subangular or angular gravel and cobbles by volume; nonsticky to slightly sticky, nonplastic; pH ranges from 6.0 to 7.0; 2 to 10 inches thick.
Subsoil Layers:	Dark yellowish brown to dark brown, nongravelly to gravelly, loamy sand to silt loam; single grained or weak to moderate, fine, subangular blocky structure; 20 to 50 percent subangular or angular gravel, cobbles and stones by volume; nonsticky to slightly sticky, nonplastic to slightly plastic; pH ranges from 6.0 to 7.0; 10 to 38 inches thick.

MAPPING UNIT 83

Landtype 83 occurs on steep, nondissected to slightly dissected sideslopes of greater than 35 percent. This landtype ranges in elevation from 3300 to 5400 feet and supports an associated species stand 1/.

Mapping Unit 83 consists dominantly of landtype 83 and minor amounts of landtype 84 which supports ponderosa pine stands.

Soil 83 is a deep to very deep, slightly plastic to plastic soil derived from residuum and colluvium. Surface soils are thin, nongravelly to very gravelly, loams or sandy clay loams. Subsoils are generally moderately thick to thick, gravelly to very gravelly, clay loams or silty clays. This soil is moderately well to well (locally imperfectely) drained. Permeability is rapid in the surface soils and moderately rapid to slow in the subsoils.

Bedrock is composed of moderately competent to incompetent, moderately hard, gray to light gray pyroclastic rock with local inclusions of hard basalt or andesite. Depth to bedrock ranges from 40 to 110 inches.

Range of Profile Characteristics of Soil 83

Litter:	Needles, leaves, twigs and decomposing organic matter. 1 to 2 inches thick.
Surface Layers:	Dark reddish brown to dark brown, nongravelly to gravelly, loam to sandy clay loam; weak to moderate, fine, crumb or subangular blocky structure; 20 to 60 percent angular or subangular gravel by volume; slightly sticky to sticky, slightly plastic to plastic; pH ranges from 6.0 to 7.0; 6 to 18 inches thick.
Subsoil Layers:	Reddish brown to dark gray, gravelly to very gravelly, loam to silty clay; moderate to strong, fine, angular or subangular blocky structure; 35 to 80 percent subangular or angular gravel, cobbles and stones by volume; slightly sticky to sticky, slightly plastic to plastic; pH ranges from 5.5 to 7.0; greater than 36 inches thick.

1/ A predominance of white fir, Douglas-fir and western larch with ponderosa pine or lodgepole pine sometimes common.

MAPPING UNIT 84

Landtype 84 occurs on steep, nondissected to slightly dissected sideslopes of greater than 35 percent. This landtype ranges in elevation from 3600 to 5400 feet and supports ponderosa pine stands.

Mapping Unit 84 consists dominantly of landtype 84 and minor amounts of landtype 83 which supports an associated species stand.

Soil 84 is a deep to very deep, slightly plastic to plastic soil derived from residuum and colluvium. Surface soils are thin, nongravelly to very gravelly, loams or sandy clay loams. Subsoils are generally moderately thick to thick, clay loams or silty clays. This soil is moderately well to well (locally imperfectly) drained. Permeability is rapid in the surface soils and moderately rapid to slow in the subsoils.

Bedrock is composed of moderately competent to incompetent, moderately hard, gray to light gray pyroclastic rock with local inclusions of hard basalt or andesite. Depth to bedrock ranges from 40 to 110 inches.

Range of Profile Characteristics of Soil 84

Litter:	Needles, leaves, twigs and decomposing organic matter. 1 to 2 inches thick.
Surface Layers:	Dark reddish brown to dark brown, nongravelly to gravelly, loam to silty clay loam; weak to moderate, fine, crumb or subangular blocky structure; 30 to 60 percent angular or subangular gravel by volume; slightly sticky to sticky, slightly plastic to plastic; pH ranges from 6.0 to 7.0; 6 to 18 inches thick.
Subsoil Layers:	Reddish brown to dark gray, gravelly to very gravelly, loam to silty clay; moderate to strong, fine, angular or subangular blocky structure; 35 to 80 percent subangular or angular gravel, cobbles and stones by volume; slightly sticky to sticky, slightly plastic to plastic; pH ranges from 5.5 to 7.0; greater than 36 inches thick.

MAPPING UNIT 85

Landtype 85 occurs on steep, nondissected to slightly dissected, somewhat uneven sideslopes of greater than 35 percent. This landtype ranges in elevation from 5700 to 6800 feet and supports an upper forest association 1/ or local lodgepole pine stands.

Mapping Unit 85 consists dominantly of landtype 85 and minor amounts of landtype 86 which supports an associated species stand and landtype 96 which occurs on gentle slopes.

Soil 85 is a deep to very deep, slightly plastic to plastic soil derived from aeolian and/or residuum. Surface soils are generally thin, silt loams or loams. Locally, ash deposits are present. Subsoils are generally moderately thick to thick, nongravelly, silt loams, silty clay loams or silty clays. This soil is well drained. Permeability is rapid in the surface soils and moderately rapid to slow in the subsoils.

Bedrock is composed of competent to moderately competent, moderately hard to soft pyroclastic rock or weathered vasicular basalt rock. Depth to bedrock ranges from 40 to 120 inches.

Range of Profile Characteristics of Soil 85

Litter:	Needles, leaves, twigs and decomposing organic matter. ½ to 1½ inches thick.
Surface Layers: 2/	Brown to dark brown, nongravelly, loam to silt loam, weak or moderate, fine, subangular blocky structure; 0 percent gravel by volume; nonsticky to slightly sticky, nonplastic to slightly plastic; pH ranges from 5.5 to 6.5; 6 to 18 inches thick.
Subsoil Layers:	Reddish brown to dark brown; nongravelly, silt loam to silty clay; massive or moderate, fine, subangular blocky structure; 0 percent gravel by volume; slightly sticky to sticky, slightly plastic to plastic; pH ranges from 5.5 to 6.5; greater than 36 inches thick.

1/ A predominance of subalpine fir and Engelmann spruce with lodgepole pine, western larch and white fir occurring to a lesser extent.

2/ Locally, surface soils are silt loam ash deposits.

MAPPING UNIT 86

Landtype 86 occurs on steep, nondissected to slightly dissected, somewhat uneven sideslopes of greater than 35 percent. This landtype ranges in elevation from 3400 to 5900 feet and supports an associated species stand 1/.

Mapping Unit 86 consists dominantly of landtype 86 and minor amounts of landtype 85 which supports an upper forest association and landtype 98 which occurs on gentle slopes.

Soil 86 is a deep to very deep, slightly plastic to plastic soil derived from aeolian and/or residuum. Surface soils are generally thin, silt loams or loams. Locally, ash deposits are present. Subsoils are generally moderately thick to thick, nongravelly, silt loams, silty clay loams or silty clays. This soil is well drained. Permeability is rapid in the surface soils and moderately rapid to slow in the subsoils.

Bedrock is composed of competent to moderately competent, moderately hard to soft pyroclastic rock or weathered vesicular basalt rock. Depth to bedrock ranges from 40 to 120 inches.

Range of Profile Characteristics of Soil 86

Litter:	Needles, leaves, twigs and decomposing organic matter. ½ to 1½ inches thick.
Surface Layers: 2/	Brown to dark brown, nongravelly, loam to silt loam, weak or moderate, fine, subangular blocky structure; 0 percent gravel by volume; nonsticky to slightly sticky, nonplastic to slightly plastic; pH ranges from 5.5 to 6.5; 6 to 18 inches thick.
Subsoil Layers:	Reddish brown to dark brown; nongravelly, silt loam to silty clay; massive or moderate, fine, subangular blocky structure; 0 percent gravel by volume; slightly sticky to sticky, slightly plastic to plastic; pH ranges from 5.5 to 6.5; greater than 36 inches thick.

1/ A predominance of white fir, western larch and Douglas-fir with ponderosa pine or lodgepole pine sometimes common.

2/ Locally, surface soils are silt loam ash deposits.

MAPPING UNIT 87

Landtype 87 occurs on steep, dissected sideslopes of greater than 35 percent. This landtype ranges in elevation from 3800 to 5800 feet and supports an associated species stand 1/.

Mapping Unit 87 consists dominantly of landtype 87 and minor amounts of landtype 88 which supports ponderosa pine.

Soil 87 is a shallow to moderately deep, slightly plastic to plastic soil derived from colluvium and residuum. Surface soils are thin to moderately thick, nongravelly to gravelly, loams or silty clay loams. Subsoils are thin to moderately thick, nongravelly to gravelly, loams, silty clay loams or clay loams. This soil is well drained. Permeability is rapid in the surface soils and rapid to moderately rapid in the subsoils.

Bedrock is composed of competent to moderately competent, hard to moderately hard pyroclastic rock with local inclusions of hard basalt or andesite. Depth to bedrock ranges from 20 to 40 inches.

Range of Profile Characteristics of Soil 87

Litter:	Needles, leaves, twigs and decomposing organic matter. ½ to 1½ inches thick.
Surface Layers:	Dark reddish brown to yellowish brown, nongravelly to gravelly, loam to silt loam; weak, fine, crumb structure; 15 to 40 percent subangular or angular gravel by volume; nonsticky to slightly sticky, nonplastic to slightly plastic; pH ranges from 6.0 to 7.0; 8 to 20 inches thick.
Subsoil Layers:	Dark brown to dark yellowish brown, nongravelly to gravelly, loam to clay loam (locally silty clay); weak or moderate, fine, subangular blocky or crumb structure; 15 to 50 percent subangular or angular gravel and cobbles by volume; nonsticky to slightly sticky, nonplastic to slightly plastic (locally sticky and plastic); pH ranges from 6.0 to 7.0; 12 to 32 inches thick.

1/ A predominance of white fir, western larch and Douglas-fir with ponderosa pine, Engelmann spruce and lodgepole pine sometimes common.

MAPPING UNIT 88

Landtype 88 occurs on steep, dissected sideslopes of greater than 35 percent. This landtype ranges in elevation from 3400 to 5200 feet and supports dominantly of ponderosa pine with some Douglas-fir and western larch common.

Mapping Unit 88 consists dominantly of landtype 88 and minor amounts of landtype 87 which supports an associated species stand.

Soil 88 is a shallow to moderately deep, slightly plastic to plastic soil derived from colluvium and residuum. Surface soils are thin to moderately thick, nongravelly to gravelly, loams or silty clay loams. Subsoils are thin to moderately thick, nongravelly to gravelly, loams. silty clay loams or clay loams. This soil is well drained. Permeability is rapid in the surface soils and rapid to moderately rapid in the subsoils.

Bedrock is composed of competent to moderately competent, hard to moderately hard pyroclastic rock with local inclusions of hard basalt or andesite. Depth to bedrock ranges from 20 to 40 inches.

Range of Profile Characteristics of Soil 88

Litter:	Needles, leaves, twigs and decomposing organic matter. ½ to 1 inch thick.
Surface Layers:	Dark reddish brown to yellowish brown, nongravelly to gravelly, loam to silt loam; weak, fine, crumb structure; 15 to 40 percent subangular or angular gravel by volume; nonsticky to slightly sticky, nonplastic to slightly plastic; pH ranges from 6.0 to 7.0; 8 to 20 inches thick.
Subsoil Layers:	Dark brown to dark yellowish brown, nongravelly to gravelly, loam to clay loam (locally silty clay); weak or moderate, fine, subangular blocky or crumb structure; 15 to 50 percent subangular or angular gravel and cobbles by volume; nonsticky to slightly sticky, nonplastic to slightly plastic (locally sticky and plastic); pH ranges from 6.0 to 7.0; 12 to 32 inches thick.

MAPPING UNIT 89

Landtype 89 occurs on steep, somewhat uneven, dissected sideslopes and toeslopes of greater than 35 percent. This landtype ranges in elevation from 4200 to 5600 feet and supports an associated species stand 1/ with ponderosa pine more dominant at times.

Mapping Unit 89 consists dominantly of landtype 89 and minor amounts of landtype 69 which has ash deposits of greater than 4 inches and landtype 94 which occurs on uneven, gentle slopes.

Soil 89 is a deep to very deep, plastic soil derived from residuum and colluvium. Surface soils are thin to moderately thick, nongravelly to gravelly, silt loams or loams. Subsoils are generally thick, non-gravelly to gravelly (locally very gravelly) clay loams or silty clays. This soil is moderately well to imperfectly drained. Permeability is rapid in the surface soils and moderate to slow in the subsoils.

Bedrock is composed of incompetent, soft (locally saprolitic) pyrocalstic rock with local inclusions of harder pyroclastic or basalt rock. Depth to bedrock ranges from 40 to greater than 144 inches.

Range of Profile Characteristics of Soil 89

Litter:	Needles, leaves, twigs and decomposing organic matter. ½ to 2 inches thick.
Surface Layers:	Dark brown to dark yellowish brown, nongravelly to gravelly, silt loam to loam; weak to moderate, fine to medium, subangular blocky structure; 10 to 40 percent subangular gravel and cobbles by volume; slightly sticky to sticky, nonplastic to slightly plastic; pH ranges from 5.5 to 6.5; 12 to 20 inches thick.
Subsoil Layers:	Dark brown to very pale brown, nongravelly to gravelly, silty clay to silty clay loam; massive or strong, medium subangular blocky structure; 0 to 45 percent subangular or subrounded gravel and cobbles by volume; slightly sticky to very sticky, slightly plastic to plastic; pH ranges from 5.5 to 7.0; greater than 28 inches thick.

1/ A predominance of white fir, western larch and Douglas-fir with ponderosa pine, lodgepole pine and Englemann spruce sometimes common.

MAPPING UNIT 91

Landtype 91 occurs on gentle ridgetops and benches of less than 35 percent slope. This landtype ranges in elevation from 3600 to 5800 feet and supports an associated species stand 1/.

Mapping Unit 91 consists dominantly of landtype 91 and minor amounts of landtype 81 which occurs on steep slopes and landtype 92 which supports ponderosa pine stands.

Soil 91 is a shallow to moderately deep, nonplastic soil derived from residuum. Surface soils are thin, nongravelly, silt loams, loams or sandy loams. Subsoils are generally thin, nongravelly to gravelly, silt loams or clay loams. This soil is well drained. Permeability is rapid in the surface soils and rapid to moderately rapid in the subsoils.

Bedrock is composed of competent to moderately competent, moderately hard pyroclastic rock with local inclusions of hard basalt or andesite. Depth to bedrock ranges from 10 to 40 inches.

Range of Profile Characteristics of Soil 91

Litter:	Needles, leaves, twigs and decomposing organic matter. ½ to 1½ inches thick.
Surface Layers:	Dark brown to dark yellowish brown, nongravelly, sandy loam to silt loam; weak, fine, subangular blocky or crumb structure; 5 to 35 percent subangular or angular gravel by volume; nonsticky, nonplastic; pH ranges from 6.0 to 7.0; 4 to 18 inches thick.
Subsoil Layers:	Dark brown to grayish brown, nongravelly to gravelly, loam to clay loam; massive or weak, fine, subangular blocky structure; 5 to 40 percent subangular or angular gravel, cobbles and stones by volume; nonsticky to sticky, nonplastic to plastic; pH ranges from 5.5 to 7.0; 6 to 36 inches thick.

1/ A predominance of white fir, western larch and Douglas-fir with ponderosa pine or lodgepole pine sometimes common.

MAPPING UNIT 92

Landtype 92 occurs on gentle ridgetops and benches of less than 35 percent slope. This landtype ranges in elevation from 3200 to 5300 feet and supports ponderosa pine stands.

Mapping Unit 92 consists dominantly of landtype 92 and minor amounts of landtype 82 which occurs on steep slopes and landtype 91 which supports an associated species stand.

Soil 92 is a shallow to moderately deep, nonplastic soil derived from residuum. Surface soils are thin, nongravelly, loams, silt loams or clay loams. Subsoils are generally thin, nongravelly to gravelly, silt loams or sandy loams. This soil is well drained. Permeability is rapid in the surface soils and rapid to moderately rapid in the subsoils.

Bedrock is composed of competent to moderately competent, moderately hard pyroclastic rock with local inclusions of hard basalt or andesite. Depth to bedrock ranges from 10 to 40 inches.

Range of Profile Characteristics of Soil 92

Litter:	Needles, leaves, twigs and decomposing organic matter. 0 to 1 inch thick.
Surface Layers:	Dark brown to dark yellowish brown, nongravelly, sandy loam to silt loam; weak, fine, subangular blocky or crumb structure; 5 to 25 percent subangular or angular gravel by volume;nonsticky to slightly sticky, nonplastic to slightly plastic; pH ranges from 6.0 to 7.0; 4 to 18 inches thick.
Subsoil Layers:	Dark brown to reddish brown, nongravelly to gravelly, sandy loam to silt; massive or weak to moderate, fine, subangular blocky structure; 5 to 40 percent subangular or angular gravel, cobbles and stones by volume; nonsticky to sticky, nonplastic to plastic; pH ranges from 5.5 to 7.0; 6 to 36 inches thick.

MAPPING UNIT 93

Landtype 93 occurs on gentle, slightly uneven toeslopes of less than 35 percent. This landtype ranges in elevation from 3800 to 5000 feet and supports open ponderosa pine, grass and brush areas.

Mapping Unit 93 consists dominantly of landtype 93.

Soil 93 is a very shallow to shallow, nonplastic soil derived from residuum. Surface soils are very thin, sandy loams or loams. Subsoils are thin, nongravelly to gravelly, sandy loams, loams or silt loams. This soil is well drained. Permeability is rapid.

Bedrock is composed of moderately competent to competent, moderately hard to hard, pyroclastic rock with local inclusions of hard basalt or andesite. Depth to bedrock ranges from 6 to 20 inches.

Range of Profile Characteristics of Soil 93

Litter:	Needles, leaves, twigs and decomposing organic matter. 0 to 3/4 inch thick.
Surface Layers:	Brown to very dark grayish brown, nongravelly, sandy loam to silt loam; single grained or weak, fine, subangular blocky structure; 0 to 20 percent subangular gravel by volume; nonsticky, nonplastic; pH ranges from 5.5 to 6.5; 2 to 8 inches thick.
Subsoil Layers:	Brown to dark grayish brown, nongravelly to gravelly, sandy loam to silt loam; single grained or weak, fine, subangular blocky structure; 5 to 40 percent subangular gravel and cobbles by volume; nonsticky, nonplastic; pH ranges from 5.5 to 7.0; 12 to 18 inches thick.

MAPPING UNIT 94

Landtype 94 occurs on gentle, uneven and somewhat dissected toeslopes and in concave positions of less than 35 percent slope. This landtype ranges in elevation from 4000 to 5300 feet and supports an associated species stand 1/ and local lodgepole pine stands.

Mapping Unit 94 consists dominantly of landtype 94 and minor amounts of landtype 95 which supports ponderosa pine, landtype 89 which occurs on steep, dissected slopes and landtype 77 which has ash deposits of greater than 4 inches thick.

Soil 94 is a deep to very deep, slightly plastic to very plastic soil derived from residuum. Surface soils are thin, nongravelly, loams or silt loams. Subsoils are generally moderately thick to thick, nongravelly to gravelly, silty clay loams, silty clays or clays. This soil is moderately well to imperfectly drained. Permeability is rapid in the surface soils and moderately rapid to slow in the subsoils.

Bedrock is composed of incompetent, soft pyroclastic rock. Depth to bedrock is greater than 40 inches.

Range of Profile Characteristics of Soil 94

Litter:	Needles, leaves, twigs and decomposing organic matter. 1 to 2 inches thick.
Surface Layers:	Very dark gray to dark brown, nongravelly, loam to clay loam; weak to moderate, fine, subangular blocky structure; 0 to 35 percent subangular gravel by volume; slightly sticky, slightly plastic; pH ranges from 5.5 to 7.0; 8 to 18 inches thick.
Subsoil Layers:	Dark grayish brown to yellowish brown, nongravelly to gravelly, clay loam to clay; massive or strong, medium, angular blocky structure; 5 to 50 percent subangular gravel, cobbles and stones by volume; sticky to very sticky, slightly plastic to very plastic; pH ranges from 5.5 to 7.0; greater than 32 inches thick.

1/ A predominance of white fir, Douglas-fir and western larch with lodgepole pine and ponderosa pine sometimes common.

MAPPING UNIT 95

Landtype 95 occurs on gentle, uneven and somewhat dissected toeslopes and in concave positions of less than 35 percent slope. This landtype ranges in elevation from 4200 to 5200 feet and supports ponderosa pine.

Mapping Unit 95 consists dominantly of landtype 95 and minor amounts of landtype 94 which supports an associated species stand.

Soil 95 is a deep to very deep, slightly plastic to very plastic soil derived from residuum. Surface soils are thin, nongravelly, loams, silt loams or clay loams. Subsoils are generally moderately thick to thick, nongravelly to gravelly, silty clay loams, silty clays or clays. This soil is moderately well to imperfectly drained. Permeability is rapid in the surface soils and moderately rapid to slow in the subsoils.

Bedrock is composed of incompetent, soft pyroclastic rock. Depth to bedrock is greater than 40 inches.

Range of Profile Characteristics of Soil 95

Litter:	Needles, leaves, twigs and decomposing organic matter. 0 to 1 inch thick.
Surface Layers: 1/	Very dark gray to dark brown, nongravelly, loam to clay loam; weak to moderate, fine, subangular blocky structure; 0 to 35 percent subangular gravel by volume; slightly sticky, slightly plastic; pH ranges from 5.5 to 7.0; 8 to 18 inches thick.
Subsoil Layers:	Dark grayish brown to yellowish brown, nongravelly to gravelly, clay loam to clay; massive or strong medium angular blocky structure; 5 to 50 percent subangular gravel, cobbles and stones by volume; sticky to very sticky, plastic to very plastic; pH ranges from 5.5 to 7.0; greater than 32 inches thick.

1/ Locally, silt loam ash deposits may occur. Generally the deposits are intermittent and generally less than 6 inches thick.

MAPPING UNIT 96

Landtype 96 occurs on gentle, rolling to flat slopes, terraces and toeslopes of less than 35 percent. This landtype ranges in elevation from 5400 to 6800 feet and supports an upper forest association 1/.

Mapping Unit 96 consists dominantly of landtype 96 and minor amounts of landtype 97 which supports lodgepole pine stands, landtype 98 which supports an associated species stand and landtype 85 which occurs on steep slopes.

Soil 96 is a deep to very deep, nonplastic to plastic soil derived from aeolian deposits (ash and/or loess) and/or residuum. Surface soils are generally very thin to thin silt loam ash deposits (locally ash deposits are absent). Buried soils are generally moderately thick to thick, nongravelly, loams or silt loams. This soil is well drained. Permeability is rapid in the surface soils and moderately rapid to slow in the buried soils.

Bedrock is composed of incompetent, soft pyroclastic rock with local inclusions of basalt or andesite. Depth to bedrock is greater than 40 inches.

Range of Profile Characteristics of Soil 96

Litter:	Needles, leaves, twigs and decomposing organic matter. ½ to 1½ inches thick.
Surface Layers: 2/	Light yellowish brown to brown, silt loam; single grained or weak, fine, subangular blocky structure; 0 to 5 percent subangular gravel by volume; nonsticky, nonplastic; pH ranges from 6.0 to 7.0; 4 to 18 inches thick.
Buried Layers:	Dark brown to reddish brown, nongravelly, loam to silt clay; massive or weak to moderate, fine, subangular blocky structure; 0 to 25 percent subangular or subrounded gravel and cobbles by volume; slightly sticky to sticky, slightly plastic to plastic; pH ranges from 6.0 to 7.0; greater than 40 inches thick.

1/ A predominance of subalpine fir and Engelmann spruce with lodgepole pine, western larch and white fir occurring to a lesser extent.

2/ Locally, ash deposits may be absent. Surface soils are most commonly loams or silt loams under these conditions.

MAPPING UNIT 97

Landtype 97 occurs on gentle, rolling to flat slopes, terraces and toeslopes of less than 35 percent. This landtype ranges in elevation from 3800 to 5800 feet and supports a lodgepole pine stand.

Mapping Unit 97 consists dominantly of landtype 97 and minor amounts of landtype 96 which supports an upper forest association, landtype 98 which supports an associated species stand and landtype 85 which occurs on steep slopes.

Soil 97 is a deep to very deep, nonplastic to plastic soil derived from aeolian deposits (ash and/or loess) and/or residuum. Surface soils are generally very thin to thin silt loam ash deposits (locally ash deposits are absent). Buried soils are generally moderately thick to thick, nongravelly, loams or silt loams. This soil is well drained. Permeability is rapid in the surface soils and moderately rapid to slow in the buried soils.

Bedrock is composed of incompetent, soft pyroclastic rock with local inclusions of basalt or andesite. Depth to bedrock is greater than 40 inches.

Range of Profile Characteristics of Soil 97

Litter:	Needles, leaves, twigs and decomposing organic matter. ½ to 1½ inches thick.
Surface Layers: 1/	Light yellowish brown to brown, silt loam; single grained or weak, fine, subangular blocky structure; 0 to 5 percent subangular gravel by volume; nonsticky, nonplastic; pH ranges from 6.0 to 7.0; 4 to 18 inches thick.
Buried Layers:	Dark brown to reddish brown, nongravelly, loam to silt clay; massive or weak to moderate, fine, subangular blocky structure; 0 to 25 percent subangular or subrounded gravel and cobbles by volume; slightly sticky to sticky, slightly plastic to plastic; pH ranges from 6.0 to 7.0; greater than 40 inches thick.

1/ Locally, ash deposits may be absent. Surface soils are most commonly loams to silt loams under these conditions.

MAPPING UNIT 98

Landtype 98 occurs on gentle, rolling to flat slopes, terraces and toeslopes of less than 35 percent. This landtype ranges in elevation from 3200 to 5700 feet and supports an associated species stand 1/.

Mapping Unit 98 consists dominantly of landtype 98 and minor amounts of landtype 96 which supports an upper forest association, landtype 97 which supports lodgepole pine stands, landtype 99 which supports ponderosa pine stands and landtype 86 which occurs on steep slopes.

Soil 98 is a deep to very deep, nonplastic to plastic soil derived from aeolian deposits (ash and/or loess) and/or residuum. Surface soils are generally very thin to thin silt loam ash deposits (locally ash deposits are absent). Buried soils are generally moderately thick to thick, nongravelly, loams or silt loams. This soil is well drained. Permeability is rapid in the surface soil and moderately rapid to slow in the buried soils.

Bedrock is composed of incompetent, soft pyroclastic rock with local inclusions of basalt or andesite. Depth to bedrock is greater than 40 inches.

Range of Profile Characteristics of Soil 98

Litter:	Needles, leaves, twigs and decomposing organic matter. ½ to 2 inches thick.
Surface Layers: 2/	Light yellowish brown to dark reddish brown, silt loam; single grained or weak, fine, subangular blocky structure; 0 to 5 percent subangular gravel by volume; nonsticky, nonplastic; pH ranges from 6.0 to 7.0; 4 to 18 inches thick.
Buried Layers:	Dark brown to reddish brown, nongravelly, loam to silt clay; massive or weak to moderate, fine, subangular blocky structure; 0 to 25 percent subangular or subrounded gravel and cobbles by volume; slightly sticky to sticky, slightly plastic to plastic; pH ranges from 6.0 to 7.0; greater than 40 inches thick.

1/ A predominance of white fir, western larch and Douglas-fir with ponderosa pine or lodgepole pine sometimes common.

2/ Locally, ash deposits may be absent. Surface soils are most commonly loams to silt loams under these conditions.

MAPPING UNIT 99

Landtype 99 occurs on gentle, rolling to flat slopes, terraces and toeslopes of less than 35 percent. This landtype ranges in elevation from 3100 to 3800 feet and supports ponderosa pine stands.

Mapping Unit 99 consists dominantly of landtype 99 and minor amounts of landtype 98 which supports an associated species stand.

Soil 99 is a deep to very deep, nonplastic to slightly plastic soil derived from aeolian deposits (loess) and/or residuum. Surface soils are generally very thin to thin silt loams or loams. Subsoils are generally moderately thick to thick, nongravelly, loams, silt loams or clay loams. This soil is well drained. Permeability is rapid in the surface soil and rapid or moderately rapid in the subsoils.

Bedrock is composed of incompetent, soft pyroclastic rock with local inclusions of basalt or andesite. Depth to bedrock is greater than 40 inches.

Range of Profile Characteristics of Soil 99

Litter:	Needles, leaves, twigs and decomposing organic matter. 0 to 1 inch thick.
Surface Layers: 1/	Brown to dark brown, silt loam to loam; single grained or weak, fine, subangular blocky structure; 0 to 5 percent subangular gravel by volume; nonsticky, nonplastic; pH ranges from 6.0 to 7.0; 4 to 18 inches thick.
Subsoil Layers:	Dark brown to reddish brown, nongravelly, loam to silt clay loam; massive or weak, fine, subangular blocky structure; 0 to 25 percent subangular or subrounded gravel and cobbles by volume; nonsticky to sticky, nonplastic to slightly plastic; pH ranges from 6.0 to 7.0; greater than 40 inches thick.

1/ Locally, silt loam ash deposits may be present.

MAPPING UNIT 100

Mapping Unit 100 consists primarily of andesite and basalt rock outcrop with inclusions of soil. The most common inclusions are Landtypes 5, 101 103, 105, 106, 107 and 108.

Bedrock is generally competent and highly fractured.

This mapping unit occurs on ridgecrests and steep sideslopes.

MAPPING UNIT 101

Landtype 101 occurs on steep, nondissected to slightly dissected sideslopes of greater than 35 percent. This landtype ranges in elevation from 5500 to 7000 feet and supports an upper forest association 1/.

Mapping Unit 101 consists dominantly of landtype 101 and minor amounts of landtype 102 which supports lodgepole pine stands, landtype 103 which supports an associated species stand and landtype 110 which occurs on gentle slopes.

Soil 101 is a moderately deep to deep (locally shallow), nonplastic to slightly plastic soil derived from aeolian deposits and buried colluvium and residuum. Surface soils are generally thin, silt loam ash deposits (locally ash is absent). Buried soils are thin to moderately thick, gravelly to very gravelly, loams, silt loams or silty clay loams. This soil is well drained. Permeability is rapid in the surface soils and rapid to moderately rapid in the buried soil.

Bedrock is composed of competent, hard, gray to black basalt or andesite rock with local inclusions of pyroclastic rock. Depth to bedrock ranges from 16 to 60 inches.

Range of Profile Characteristics of Soil 101

Litter:	Needles, leaves, twigs and decomposing organic matter. 1 to 2 inches thick.
Surface Layers: 2/	Yellowish brown to dark brown, nongravelly, silt loam; single grained or weak, fine subangular blocky structure; 0 to 10 percent angular or subangular blocky gravel by volume; nonsticky, nonplastic; pH ranges from 6.0 to 6.5; 4 to 20 inches thick.
Buried Layers:	Dark yellowish brown to dark reddish brown, gravelly to very gravelly, sandy loam to silty clay loam; massive or weak to moderate, fine to medium, subangular blocky or crumb structure; 35 to 80 percent subangular or angular gravel, cobbles and stones by volume; slightly sticky to sticky, slightly plastic to plastic; pH ranges from 5.5 to 6.5; 0 to 60 inches thick.

1/ A predominance of Engelmann spruce and subalpine fir with lodgepole pine, western larch and white fir occurring to a lesser extent.

2/ Locally, ash is absent. Surface soils are most commonly loam under these conditions.

MAPPING UNIT 102

Landtype 102 occurs on steep, nondissected to slightly dissected sideslopes of greater than 35 percent. This landtype ranges in elevation from 3000 to 6400 feet and supports lodgepole pine stands.

Mapping Unit 102 consists dominantly of landtype 102 and minor amounts of landtype 101 which supports an upper forest association, landtype 103 which supports an associated species stand and landtype 111 which occurs on gentle slopes.

Soil 102 is a shallow to moderately deep, nonplastic to slightly plastic soil derived from aeolian deposits and buried colluvium and residuum. Surface soils are thin, silt loam ash deposits. Buried soils are thin to moderately thick, nongravelly to gravelly, loams, silt loams or silty clay loams. This soil is well drained. Permeability is rapid in the surface soils and rapid to moderately rapid in the buried soils.

Bedrock is composed of competent, hard, gray to black basalt or andesite rock with local inclusions of pyroclastic rock. Depth to bedrock ranges from 24 to 40 inches (locally deeper).

Range of Profile Characteristics of Soil 102

Litter:	Needles, leaves, twigs and decomposing organic matter. ½ to 1½ inches thick.
Surface Layers:	Yellowish brown to dark brown, nongravelly, silt loam; single grained to weak, fine, subangular blocky structure; 0 to 10 percent angular or subangular gravel by volume; nonsticky, nonplastic; pH ranges from 6.0 to 6.5; 4 to 18 inches thick.
Buried Layers:	Dark yellowish brown to dark reddish brown, nongravelly to gravelly, loam to silty clay loam; massive or weak to moderate, fine to medium, subangular or angular blocky structure; 5 to 50 percent subangular or angular gravel, cobbles and stones by volume; slightly sticky to sticky, slightly plastic to plastic; pH ranges from 6.0 to 6.5; 6 to 36 inches thick.

MAPPING UNIT 103

Landtype 103 occurs on steep, nondissected to slightly dissected sideslopes of greater than 35 percent. This landtype ranges in elevation from 3200 to 6000 feet and supports an associated species stand 1/.

Mapping Unit 103 consists dominantly of landtype 103 and minor amounts of landtype 101 which supports an upper forest association, landtype 102 which supports lodgepole pine stands, landtype 104 which supports a ponderosa pine stand, landtype 105 on which ash is absent or less than 4 inches thick and landtype 112 which occurs on gentle slopes.

Soil 103 is a shallow to moderately deep, nonplastic to slightly plastic soil derived from aeolian deposits and buried colluvium and residuum. Surface soils are thin, silt loam ash deposits. Buried soils are thin to moderately thick, nongravelly to gravelly, loams, silt loams or silty clay loams. This soil is well drained. Permeability is rapid in the surface soils and rapid to moderately rapid in the buried soils.

Bedrock is composed of competent, hard, gray to black basalt or andesite rock with local inclusions of pyroclastic rock. Depth to bedrock ranges from 24 to 40 inches (locally deeper).

Range of Profile Characteristics of Soil 103

Litter:	Needles, leaves, twigs and decomposing organic matter. ½ to 1½ inches thick.
Surface Layers:	Yellowish brown to dark brown, nongravelly, silt loam; single grained to weak, fine, subangular blocky structure; 0 to 10 percent angular or subangular gravel by volume; nonsticky, nonplastic; pH ranges from 6.0 to 6.5; 4 to 18 inches thick.
Buried Layers:	Dark yellowish brown to dark reddish brown, nongravelly to gravelly, loam to silty clay loam; massive or weak to moderate, fine to medium, subangular or angular blocky structure; 5 to 50 percent subangular or angular gravel, cobbles and stones by volume; slightly sticky to sticky, slightly plastic to plastic; pH ranges from 6.0 to 6.5; 6 to 36 inches thick.

1/ A predominance of white fir, western larch and Douglas-fir with ponderosa pine, lodgepole pine and Engelmann spruce sometimes common.

MAPPING UNIT 104

Landtype 104 occurs on steep, nondissected to slightly dissected slopes of greater than 35 percent with southerly aspects. This landtype ranges in elevation from 3000 to 5900 feet and supports ponderosa pine stands with some Douglas-fir and white fir.

Mapping Unit 104 consists dominantly of landtype 104 and minor amounts of landtype 103 which supports associated species stands, landtype 106 which has generally more shallow soils and is more droughty, and landtype 113 which occurs on gentle slopes.

Soil 104 is a shallow to moderately deep, nonplastic to slightly plastic soil derived from residuum and colluvium. Surface soils are generally thin, nongravelly to gravelly, silt loams or silty clay loams. Subsoils are thin to moderately thick, nongravelly to gravelly, sandy loams, loams or silt loams. This soil is well drained. Permeability is rapid.

Bedrock is composed of competent, hard, gray to black basalt or andesite rock. Depth to bedrock ranges from 8 to 40 inches (locally deeper).

Range of Profile Characteristics of Soil 104

Litter:	Needles, leaves, twigs and decomposing organic matter. 0 to 1 inch thick.
Surface Layers: 1/	Dark brown to dark reddish brown, nongravelly to gravelly, silt loam to silty clay loam; weak, fine, crumb structure; 10 to 50 percent angular gravel by volume; nonsticky to slightly sticky, nonplastic to slightly plastic; pH ranges from 6.0 to 6.5; 8 to 24 inches thick.
Subsoil Layers:	Brown to dark grayish brown, nongravelly to gravelly, sand loam to clay loam; single grained or weak, fine, subangular blocky structure; 20 to 50 percent angular gravel, cobbles and stones by volume; nonsticky to slightly sticky, nonplastic to slightly plastic; pH ranges from 6.0 to 6.5; 16 to 32 inches thick.

1/ Locally, ash deposits may be present. Most often the ash is intermittent and thin.

MAPPING UNIT 105

Landtype 105 occurs on steep, nondissected to slightly dissected sideslopes of greater than 35 percent. This landtype ranges in elevation from 3500 to 6000 feet and supports an associated species stand 1/.

Mapping Unit 105 consists dominantly of landtype 105 and minor amounts of landtype 103 which has ash surface soils of greater than 4 inches thick, landtype 104 which supports ponderosa pine, and landtype 115 which occurs on gentle slopes.

Soil 105 is a shallow to moderately deep, nonplastic to slightly plastic soil derived from residuum and colluvium. Surface soils are thin loams or silt loams. Subsoils are thin to moderately thick, gravelly to very gravelly loams or silt loams. This soil is well drained. Permeability is rapid.

Bedrock is composed of competent, hard, gray to black basalt or andesite rock. Depth to bedrock ranges from 14 to 40 inches.

Range of Profile Characteristics of Soil 105

Litter:	Needles, leaves, twigs and decomposing organic matter. ½ to 1½ inches thick.
Surface Layers:	Brown to dark reddish brown, loam to silt loam; weak, fine, subangular blocky or crumb structure; 5 to 35 percent angular gravel by volume; nonsticky to slightly sticky, nonplastic to slightly plastic; pH ranges from 6.0 to 7.0; 6 to 20 inches thick.
Subsoil Layers:	Brown to dark reddish brown, gravelly to very gravelly, loam to clay loam; massive or weak, fine, subangular blocky structure; 35 to 70 percent angular gravel, cobbles and stones by volume; nonsticky to slightly sticky, nonplastic to slightly plastic; pH ranges from 5.5 to 7.0; 8 to 34 inches thick.

1/ A predominance of white fir, western larch and Douglas-fir with ponderosa pine and lodgepole pine sometimes common.

MAPPING UNIT 106

Landtype 106 occurs on steep, nondissected to slightly dissected sideslopes of greater than 35 percent. This landtype ranges in elevation from 2800 to 5200 feet and supports open ponderosa pine stands.

Mapping Unit 106 consists dominantly of landtype 106 and minor amounts of landtype 104 which has generally deeper soils and is less droughty and landtype 117 which occurs on gentle slopes.

Soil 106 is a very shallow to moderately deep, nonplastic to slightly plastic soil derived from residuum and colluvium. Surface soils are very thin, loams or silty clay loams. Subsoils are thin, gravelly, loams or clay loams. This soil is well drained. Permeability is rapid in the surface soils and rapid to moderately rapid in the subsoils.

Bedrock is composed of competent, hard, dark gray basalt or andesite rock. Depth to bedrock ranges from 8 to 30 inches.

Range of Profile Characteristics of Soil 106

Litter:	Needles, leaves, twigs and decomposing organic matter. 0 to 1 inch thick.
Surface Layers:	Dark brown to dark reddish brown, nongravelly to gravelly, loam to silty clay loam; weak to moderate, fine, crumb structure; 15 to 50 percent angular gravel and cobbles by volume; slightly sticky, nonplastic to slightly plastic; pH ranges from 6.5 to 7.0; 6 to 16 inches thick.
Subsoil Layers:	Dark yellowish brown to dark reddish brown, nongravelly to very gravelly, loam to silty clay; weak to strong, fine or medium, crumb or angular blocky structure; 35- to 70 percent angular gravel, cobbles and stones by volume; slightly sticky to sticky, slightly plastic to plastic; pH ranges from 6.0 to 7.0; 4 to 20 inches thick.

MAPPING UNIT 107

Landtype 107 occurs on steep, slightly dissected to dissected slopes of greater than 35 percent with northerly aspects. This landtype ranges in elevation from 3000 to 5800 feet and supports an associated species stand 1/ or ponderosa pine/Douglas-fir stands, both with a characteristic brush understory.

Mapping Unit 107 consists dominantly of landtype 107 and minor amounts of landtypes 103 and 105 which do not have brush characteristics and landtype 119 which occurs on gentle slopes.

Soil 107 is a moderately deep to deep, slightly plastic to plastic soil derived from aeolian deposits and/or colluvium and residuum. Surface soils are generally very thin to thin, silt loam, ash deposits, or nonash, nongravelly, loams or silt loams. Subsoils or buried soils are thin to moderately thick, nongravelly to gravelly (locally very gravelly), clay loams, silty clay loams or silty clays. This soil is well drained. Permeability is rapid in the surface soils and rapid to moderately rapid in the subsoils or buried soils.

Bedrock is composed of competent, hard, gray to black basalt rock. Depth to bedrock ranges from 20 to 60 inches.

Range of Profile Characteristics of Soil 107

Litter:	Needles, leaves, twigs and decomposing organic matter. 1 to 2 inches thick.
Surface Layers: 2/	Very dark brown to reddish brown, nongravelly loam to silt loam; weak to moderate, fine, subangular blocky structure; 5 to 35 percent angular gravel by volume; nonsticky to slightly sticky, nonplastic to slightly plastic; pH ranges from 5.5 to 6.5; 6 to 18 inches thick.
Subsoil or Buried Layers:	Dark yellowish brown to dark brown, nongravelly to gravelly (locally very gravelly), silt loam to silty clay; massive or moderate, fine, subangular blocky structure; 10 to 70 percent angular gravel, cobbles and stones by volume; slightly sticky to very sticky, slightly plastic to very plastic; pH ranges from 5.5 to 6.5; 2 to 54 inches thick.

1/ A predominance of white fir, Douglas-fir and western larch with some ponderosa pine or lodgepole pine locally.

2/ Ash deposits, silt loam, may be present to a thickness of 18 inches.

MAPPING UNIT 108

Landtype 108 occurs on steep, dissected sideslopes of greater than 35 percent. This landtype ranges in elevation from 2800 to 5400 feet and supports an associated species stand 1/ or ponderosa pine/Douglas-fir stands.

Mapping Unit 108 consists dominantly of landtype 108 and minor amounts of landtypes 104 and 105 which occurs on nondissected to slightly dissected slopes.

Soil 108 is a shallow to moderately deep, nonplastic to slightly plastic soil derived from residuum, colluvium and locally, ash deposits. Surface soils are generally thin loams or silt loams. Subsoils are thin to moderately thick, gravelly to very gravelly loams or silt loams. This soil is well drained. Permeability is rapid.

Bedrock is composed of competent, hard, gray to black basalt or andesite rock with inclusions of pyroclastic rocks. Depth to bedrock ranges from 14 to 40 inches.

Range of Profile Characteristics of Soil 108

Litter:	Needles, leaves, twigs and decomposing organic matter. ½ to 1½ inches thick.
Surface Layers: 2/	Brown to dark reddish brown, loam to silt loam; weak, fine, subangular blocky or crumb structure; 5 to 35 percent angular gravel by volume; nonsticky to slightly sticky, nonplastic to slightly plastic; pH ranges from 6.0 to 7.0; 6 to 18 inches thick.
Subsoil Layers:	Brown to dark reddish brown, gravelly to very gravelly, loam to clay loam; massive or weak, fine, subangular blocky structure; 35 to 70 percent angular gravel, cobbles and stones by volume; nonsticky to slightly sticky, nonplastic to slightly plastic; pH ranges from 5.5 to 7.0; 8 to 36 inches thick.

1/ A predominance of white fir, western larch and Douglas-fir with ponderosa pine and Engelmann spruce sometimes common.

2/ Locally, ash deposits, silt loam, may be present to a thickness of 18 inches.

MAPPING UNIT 110

Landtype 110 occurs on gentle ridgetops and benches of less than 35 percent slope. This landtype ranges in elevation from 4400 to 6800 feet and supports an upper forest association 1/.

Mapping Unit 110 consists dominantly of landtype 110 and minor amounts of landtype 111 which supports lodgepole pine, landtype 112 which supports an associated species stand and landtype 101 which occurs on steep slopes.

Soil 110 is a shallow to moderately deep (locally deep), nonplastic to plastic soil derived from aeolian deposits and buried residuum. Surface soils are thin silt loam ash deposits. Buried soils are thin to moderately thick, nongravelly to gravelly, loams, silt loams, clay loams or silty clay loams. This soil is well drained. Permeability is rapid in the surface soils and rapid to moderately rapid in the buried soils.

Bedrock is composed of competent, hard, gray to black basalt or andesite rock. Depth to bedrock ranges from 18 to 50 inches.

Range of Profile Characteristics of Soil 110

Litter:	Needles, leaves, twigs and decomposing organic matter. ½ to 1½ inches thick.
Surface Layers: 2/	Yellowish brown to dark brown, silt loam; single grained or weak, fine, subangular blocky structure; 0 to 10 percent angular gravel by volume; nonsticky, nonplastic; pH ranges from 5.5 to 6.5; 4 to 18 inches thick.
Buried Layers:	Dark brown to dark yellowish brown, nongravelly to gravelly, loam to silty clay loam; massive or weak to moderate, fine, subangular or angular blocky structure; 20 to 50 percent angular gravel and cobbles by volume; nonsticky to sticky, nonplastic to plastic; pH ranges from 6.0 to 6.5; 14 to 46 inches thick.

1/ A predominance of Engelmann spruce and subalpine fir with lodgepole pine, western larch and white fir occurring to a lesser extent.

2/ Locally, ash deposits may be absent.

MAPPING UNIT 111

Landtype 111 occurs on gentle ridgetops and benches of less than 35 percent slope. This landtype ranges in elevation from 4000 to 6700 feet and supports lodgepole pine.

Mapping Unit 111 consists dominantly of landtype 111 and minor amounts of landtype 110 which supports an upper forest association, landtype 112 which supports an associated species stand and 102 which occurs on steep slopes.

Soil 111 is a moderately deep to deep (locally deep), nonplastic to plastic soil derived from aeolian deposits and buried residuum. Surface soils are thin silt loam ash deposits. Buried soils are thin to moderately thick, nongravelly to very gravelly, loams, silt loams, clay loams or silty clay loams. This soil is well drained. Permeability is rapid in the surface soils and rapid to moderately rapid in the buried soils.

Bedrock is composed of competent, hard, gray to black basalt or andesite rock. Depth to bedrock ranges from 18 to 50 inches.

Range of Profile Characteristics of Soil 111

Litter:	Needles, leaves, twigs and decomposing organic matter. ½ to 1½ inches thick.
Surface Layers: 1/	Yellowish brown to dark brown, silt loam; single grained or weak, fine, subangular blocky structure; 0 to 10 percent angular gravel by volume; nonsticky, nonplastic; pH ranges from 5.5 to 6.5; 4 to 18 inches thick.
Buried Layers:	Dark brown to dark yellowish brown, nongravelly to very gravelly, loam to silty clay loam; massive or weak to moderate, fine, subangular or angular blocky structure; 20 to 50 percent angular gravel and cobbles by volume; nonsticky to sticky, nonplastic to plastic; pH ranges from 6.0 to 6.5; 14 to 46 inches thick.

1/ Locally ash deposits may be absent.

MAPPING UNIT 112

Landtype 112 occurs on gentle ridgetops and benches of less than 35 percent slope. This landtype ranges in elevation from 3600 to 6000 feet and supports an associated species stand 1/.

Mapping Unit 112 consists dominantly of landtype 112 and minor amounts of landtype 110 which supports an upper forest association, landtype 111 which supports lodgepole pine, landtype 113 which supports ponderosa pine, landtype 115 on which ash is absent or less than 4 inches thick, and landtype 103 which occurs on steep slopes.

Soil 112 is a moderately deep to deep, nonplastic to plastic soil derived from aeolian deposits and buried residuum. Surface soils are thin silt loam ash deposits. Buried soils are thin to moderately thick, nongravelly to very gravelly, loams, silt loams, clay loams or silty clay loams. This soil is well drained. Permeability is rapid in the surface soils and rapid to moderately rapid in the buried soils.

Bedrock is composed of competent, hard, gray to black basalt or andesite rock. Depth to bedrock ranges from 18 to 50 inches.

Range of Profile Characteristics of Soil 112

Litter:	Needles, leaves, twigs and decomposing organic matter. 1 to 2 inches thick.
Surface Layers:	Yellowish brown to dark brown, silt loam; single grained or weak, fine, subangular blocky structure; 0 to 10 percent angular gravel by volume; nonsticky, nonplastic; pH ranges from 5.5 to 6.5; 4 to 18 inches thick.
Buried Layers:	Dark brown to dark yellowish brown, nongravelly to very gravelly, loam to silty clay loam; massive or weak to moderate, fine, angular blocky structure; 20 to 50 percent angular gravel and cobbles by volume; nonsticky to sticky, nonplastic to plastic; pH ranges from 6.0 to 6.5; 14 to 46 inches thick.

1/ A predominance of white fir, western larch and Douglas-fir with ponderosa pine, lodgepole pine and Engelmann spruce sometimes common.

MAPPING UNIT 113

Landtype 113 occurs on gentle ridgetops and benches of less than 35 percent slope. This landtype ranges in elevation from 3400 to 5400 feet and supports ponderosa pine with some Douglas-fir and white fir.

Mapping Unit 113 consists dominantly of landtype 113 and minor amounts of landtype 112 which supports an associated species stand and landtype 104 which occurs on steep slopes.

Soil 113 is a shallow to moderately deep, nonplastic to slightly plastic soil derived from aeolian deposits and buried residuum. Surface soils are generally thin, silt loam, ash deposits. Buried soils are thin to moderately thick, nongravelly to gravelly, sandy loams, loams, silt loams and clay loams. This soil is well drained. Permeability is rapid.

Bedrock is composed of competent, hard, gray to black basalt or andesite rock. Depth to bedrock ranges from 10 to 40 inches.

Range of Profile Characteristics of Soil 113

Litter:	Needles, leaves, twigs and decomposing organic matter. 0 to 1 inch thick.
Surface Layers:	Light yellowish brown to brown, silt loam; single grained or weak, fine, subangular blocky structure; 0 to 5 percent angular gravel by volume; nonsticky, nonplastic; pH ranges from 6.0 to 7.0; 4 to 18 inches thick.
Buried Layers:	Dark reddish brown to brown, nongravelly to gravelly, sandy loam to clay loam; weak or moderate, fine to medium subangular blocky structure; 5 to 45 percent angular gravel and cobbles by volume; nonsticky to slightly sticky, nonplastic to slightly plastic; pH ranges from 6.0 to 7.0; 6 to 34 inches thick.

MAPPING UNIT 115

Landtype 115 occurs on gentle ridgetops and benches of less than 35 percent slope. This landtype ranges in elevation from 3500 to 6000 feet and supports an associated species stand 1/.

Mapping Unit 115 consists dominantly of landtype 115 and minor amounts of landtype 116 which supports ponderosa pine, landtype 112 which has ash surface soils of greater than 4 inches thick, and landtype 105 which occurs on steep slopes.

Soil 115 is a shallow to moderately deep, nonplastic to plastic soil derived from residuum. Surface soils are generally thin, nongravelly, sandy loams, loams, silt loams or clay loams. Subsoils are thin to moderately thick, nongravelly to gravelly, silt loams, silty clay loams or silty clays. This soil is well drained. Permeability is rapid in the surface soils and rapid to moderately rapid in the subsoils.

Bedrock is composed of competent, hard, gray to black basalt or andesite rock. Depth to bedrock ranges from 12 to 40 inches.

Range of Profile Characteristics of Soil 115

Litter:	Needles, leaves, twigs and decomposing organic matter. ½ to 1½ inches thick.
Surface Layers:	Dark yellowish brown to dark brown, nongravelly, sandy loam to clay loam; single grained or weak, fine, crumb or angular blocky structure; 0 to 35 percent angular gravel by volume; nonsticky to slightly sticky, nonplastic to slightly plastic; pH ranges from 5.5 to 6.5; 12 to 20 inches thick.
Subsoil Layers:	Dark yellowish brown to dark brown, nongravelly to gravelly, silt loam to silty clay, moderate to strong, fine or medium, angular blocky structure; 5 to 45 percent angular gravel and cobbles by volume; slightly sticky to sticky, slightly plastic to plastic; pH ranges from 5.5 to 6.5; 6 to 28 inches thick.

1/ A predominance of white fir, western larch and Douglas-fir with ponderosa pine and lodgepole pine sometimes common.

MAPPING UNIT 116

Landtype 116 occurs on gentle ridgetops and benches of less than 35 percent slope. This landtype ranges in elevation from 3000 to 5500 feet and supports ponderosa pine and some Douglas-fir.

Mapping Unit 116 consists dominantly of landtype 116 and minor amounts of landtype 115 which supports associated species, landtype 117 which supports open ponderosa pine, landtype 113 which has ash surface soils of greater than 4 inches thick and landtypes 104 and 106 which occur on steep slopes.

Soil 116 is a shallow to moderately deep, nonplastic to plastic soil derived from residuum. Surface soils are very thin to thin, loams or silt loams. Subsoils are thin, nongravelly to gravelly, clay loams or silty clays. This soil is well to moderately well drained. Permeability is rapid in the surface soils and moderately rapid in the subsoils.

Bedrock is composed of competent, hard, gray to black basalt or andesite rock. Depth to bedrock ranges from 10 to 36 inches.

Range of Profile Characteristics of Soil 116

Litter:	Needles, leaves, twigs and decomposing organic matter. 0 to 1½ inches thick.
Surface Layers:	Dark, reddish brown to dark brown, loam to silt loam; weak to moderate, fine, crumb structure; 0 to 30 percent angular gravel by volume; nonsticky to slightly sticky, nonplastic to slightly plastic; pH ranges from 5.5 to 6.0; 3 to 20 inches thick.
Subsoil Layers:	Dark yellowish brown to dark brown, nongravelly to gravelly, clay loam to silty clay; massive or weak to strong, fine to medium, angular blocky structure; 0 to 40 percent angular gravel and cobbles by volume; slightly sticky to sticky, slightly plastic to plastic; pH ranges from 5.5 to 6.5; 3 to 30 inches thick.

MAPPING UNIT 117

Landtype 117 occurs on gentle ridgetops and benches of less than 35 percent. This landtype ranges in elevation from 2800 to 5100 feet and supports open ponderosa pine with bunchgrass and shrubs.

Mapping Unit 117 consists dominantly of landtype 117 and minor amounts of landtype 116 which supports ponderosa pine and some Douglas-fir and landtype 24 which supports bunchgrasses.

Soil 117 is a very shallow to shallow (locally moderately deep), nonplastic to plastic soil derived from residuum. Surface soils are thin, nongravelly, loams, silt loams, silts or silty clays. Subsoils are thin, nongravelly to gravelly, loams, silts or silty clays. This soil is well drained. Permeability is rapid to moderately rapid.

Bedrock is composed of competent, hard, gray to black basalt rock. Depth to bedrock ranges from 6 to 20 inches.

Range of Profile Characteristics of Soil 117

Litter:	Needles, leaves, twigs and decomposing organic matter. 0 to 1 inch thick.
Surface Layers:	Very dark grayish brown to dark reddish brown, loam to silty clay; weak to moderate, fine to medium, crumb or subangular blocky structure; 0 to 15 percent angular gravel by volume; slightly sticky to sticky, nonplastic to plastic; pH ranges from 5.5 to 6.0; 3 to 12 inches thick.
Subsoil Layers:	Dark brown to dark reddish brown, loam to silty clay; massive or weak to moderate, fine, subangular or angular blocky structure; 0 to 30 percent gravel by volume; slightly sticky to sticky, slightly plastic to plastic; pH ranges from 6.0 to 6.5; 3 to 14 inches thick.

MAPPING UNIT 119

Landtype 119 occurs on gentle ridgetops and benches (locally on toeslopes and in bottom positions) of less than 35 percent slope. This landtype ranges in elevation from 3600 to 5500 feet and supports an associated species stand 1/ or ponderosa pine stands, both with a characteristic brush understory.

Mapping Unit 119 consists dominantly of landtype 119 and minor amounts of landtype 115 which characteristicly does not support a large percentage cover of brush and landtype 107 which occurs on steep slopes.

Soil 119 is a shallow to moderately deep, nonplastic to plastic soil derived from residuum and local ash deposits. Surface soils are generally thin, silt loams or loams (locally silt loam ash deposits occur). Subsoils are generally thin to moderately thick, gravelly to very gravelly, silt loams or clay loams. This soil is well to moderately well drained. Permeability is rapid in the surface soils and rapid to moderately rapid in the subsoils.

Bedrock is composed of competent, hard, gray to black basalt rock. Depth to bedrock ranges from 10 to 40 inches.

Range of Profile Characteristics of Soil 119

Litter:	Needles, leaves, twigs and decomposing organic matter. 0 to 1½ inches thick.
Surface Layers: 2/	Dark reddish brown to dark brown, loam to clay loam; weak, fine, crumb structure; 0 to 30 percent angular gravel and cobbles by volume; nonsticky to slightly sticky, nonplastic to slightly plastic; pH ranges from 6.0 to 6.5; 8 to 18 inches thick.
Subsoil Layers:	Dark reddish brown to brown, nongravelly to gravelly (locally very gravelly) silt loam to silty clay; weak to moderate, fine, crumb or angular blocky structure; 10 to 65 percent angular gravel, cobbles and stones by volume; slightly sticky to sticky, slightly plastic to plastic; pH ranges from 6.0 to 6.5; 2 to 32 inches thick.

1/ A predominance of white fir, Douglas-fir and western larch with some ponderosa pine locally.

2/ Locally, silt loam ash deposits are present.

MAPPING UNIT 120

Landtype 120 occurs on gentle, concave slopes of less than 35 percent, generally on ridgetops at the heads of minor drainages. This landtype ranges in elevation from 3500 to 5800 feet and supports an associated species stand 1/.

Mapping Unit 120 consists dominantly of landtype 120 and minor amounts of landtype 112 which occurs on convex or flat slopes and landtype 103 which occurs on steep slopes.

Soil 120 is a moderately deep to deep (locally very deep), nonplastic to plastic soil derived from aeolian deposits and buried residuum. Surface soils are thin to moderately thick, silt loam ash deposits. Buried soils are moderately thick to thick, nongravelly to gravelly, loams, silt loams, clay loams or silty clay loams. This soil is well drained. Permeability is rapid in the surface soils and rapid to moderately rapid in the buried soils.

Bedrock is composed of competent, hard, gray to black basalt or andesite rock. Depth to bedrock ranges from 30 to 80 inches.

Range of Profile Characteristics of Soil 120

Litter:	Needles, leaves, twigs and decomposing organic matter. 1 to 2 inches thick.
Surface Layers:	Yellowish brown to dark brown, silt loam; single grained or weak, fine, subangular blocky structure; 0 to 5 percent angular gravel by volume; nonsticky, nonplastic; pH ranges from 5.5 to 6.5; 4 to 24 inches thick.
Buried Layers:	Dark brown to dark yellowish brown, nongravelly to gravelly, loam to silty clay loam; massive or weak to moderate, fine, angular blocky structure; 20 to 50 percent angular gravel and cobbles by volume; nonsticky to sticky, nonplastic to plastic; pH ranges from 6.0 to 6.5; 20 to 76 inches thick.

1/ A predominance of white fir, western larch and Douglas-fir with ponderosa pine, lodgepole pine and Engelmann spruce sometimes common.

MAPPING UNIT 130

Mapping Unit 130 consists of granodiorite rock outcrops with inclusions of soil. The most common inclusions are Landtypes 5, 131, 132, 133, 134, 135 and 136.

Bedrock is generally hard and competent.

This mapping unit occurs on ridgecrests and steep sideslopes.

MAPPING UNIT 131

Landtype 131 occurs on steep, nondissected to slightly dissected sideslopes of greater than 35 percent. This landtype ranges in elevation from 5600 to 7300 feet and supports an upper forest association 1/.

Mapping Unit 131 consists dominantly of landtype 131 and minor amounts of landtype 132 which supports lodgepole pine, landtype 133 which supports an associated species stand and landtype 141 which occurs on gentle slopes.

Soil 131 is a shallow to moderately deep, nonplastic soil derived from aeolian deposits and buried residuum and colluvium. Surface soils are thin, silt loam ash deposits. Locally, ash deposits are absent and the surface soils are sandy loams. Buried soils are thin to moderately thick, nongravelly to gravelly, sandy loams or loamy sands. This soil is well drained. Permeability is rapid.

Bedrock is composed of moderately competent to competent, moderately hard granodiorite rock. Depth to bedrock ranges from 24 to 40 inches.

Range of Profile Characteristics of Soil 131

Litter:	Needles, leaves, twigs and decomposing organic matter. ½ to 1½ inches thick.
Surface Layers: 2/	Light yellowish brown to dark brown, silt loam; single grained to weak, fine, subangular blocky structure; 0 to 10 percent subangular or subrounded gravel by volume; nonsticky, nonplastic; pH ranges from 5.5 to 6.5; 4 to 18 inches thick.
Buried Layers:	Dark reddish brown to grayish brown, nongravelly to gravelly, sandy loam to sand; single grained; 5 to 45 percent subangular gravel and cobbles by volume; nonsticky, nonplastic; pH ranges from 5.5 to 7.0; 20 to 36 inches thick.

1/ A predominance of subalpine fir, Engelmann spruce and lodgepole pine with western larch and white fir occurring to a lesser extent.

2/ Locally, ash is less than 4 inches thick or absent. Surface soils are most commonly sandy loams or loams under these conditions.

MAPPING UNIT 132

Landtype 132 occurs on steep, nondissected to slightly dissected sideslopes of greater than 35 percent. This landtype ranges in elevation from 3500 to 6500 feet and supports lodgepole pine.

Mapping Unit 132 consists dominantly of landtype 132 and minor amounts of landtype 131 which supports an upper forest association, landtype 133 which supports an associated species stand and landtype 142 which occurs on gentle slopes.

Soil 132 is a shallow to moderately deep, nonplastic soil derived from aeolian deposits and buried residuum and colluvium. Surface soils are thin, silt loam ash deposits. Locally, ash deposits are absent and the surface soils are sandy loams. Buried soils are thin to moderately thick, nongravelly to gravelly, sandy loams or loams. This soil is well drained. Permeability is rapid.

Bedrock is composed of moderately competent to competent, moderately hard granodiorite rock. Depth to bedrock ranges from 30 to 40 inches.

Range of Profile Characteristics of Soil 132

Litter:	Needles, leaves, twigs and decomposing organic matter. ½ to 1½ inches thick.
Surface Layers: 1/	Light yellowish brown to brown, silt loam; single grained to weak, fine, subangular blocky structure; 0 to 10 percent subangular gravel by volume; non-sticky, nonplastic; pH ranges from 5.5 to 6.5; 4 to 18 inches thick.
Buried Layers:	Dark reddish brown to pale brown, nongravelly to gravelly, sandy loam to sand; single grained; 5 to 45 percent subangular gravel and cobbles by volume; nonsticky, nonplastic; pH ranges from 6.0 to 7.0; 20 to 36 inches thick.

1/ Locally, ash is less than 4 inches thick or absent. Surface soils are most commonly sandy loams or loams under these conditions.

MAPPING UNIT 133

Landtype 133 occurs on steep, nondissected to slightly dissected sideslopes of greater than 35 percent. This landtype ranges in elevation from 3500 to 6500 feet and supports an associated species stand 1/.

Mapping Unit 133 consists dominantly of landtype 133 and minor amounts of landtype 131 which supports an upper forest association, landtype 132 which supports lodgepole pine, landtype 134 which occurs on steep dissected sideslopes, landtype 135 which supports ponderosa pine and landtype 143 which occurs on gentle slopes.

Soil 133 is a shallow to moderately deep, nonplastic soil derived from aeolian deposits and buried colluvium and residuum. Surface soils are thin silt loam ash deposits. Buried soils are thin to moderately thick, loamy sands, sandy loams or loams. This soil is well drained. Permeability is rapid.

Bedrock is composed of moderately competent to competent, moderately hard granodiorite rock. Depth to bedrock ranges from 20 to 40 inches.

Range of Profile Characteristics of Soil 133

Litter:	Needles, leaves, twigs and decomposing organic matter. ½ to 1½ inches thick.
Surface Layers: 2/	Dark yellowish brown to dark brown, silt loam; single grained to weak, fine, subangular blocky structure; 0 to 10 percent subangular gravel by volume; nonsticky, nonplastic; pH ranges from 5.5 to 6.5; 4 to 16 inches thick.
Buried Layers:	Dark brown to gray, nongravelly to gravelly, loamy sand to loam; single grained or massive; 5 to 40 percent subangular or subrounded gravel and cobbles by volume; nonsticky, nonplastic; pH ranges from 6.0 to 7.0; 20 to 36 inches thick.

1/ A predominance of white fir, Douglas-fir and western larch with lodgepole pine, Engelmann spruce and ponderosa pine sometimes common.

2/ Locally, ash is less than 4 inches thick or absent. Surface soils are most commonly sandy loams or loams under these conditions.

MAPPING UNIT 134

Landtype 134 occurs on steep, dissected sideslopes of greater than 35 percent. This landtype ranges in elevation from 3500 to 6500 feet and supports an associated species stand 1/.

Mapping Unit 134 consists dominantly of landtype 134 and minor amounts of landtype 131 which supports an upper forest association, landtype 133 which occurs on nondissected to slightly dissected slopes and landtype 136 which supports ponderosa pine stands.

Soil 134 is a shallow to moderately deep, nonplastic soil derived from aeolian deposits and buried residuum and colluvium. Surface soils are thin, silt loam ash deposits. Locally, ash deposits are absent and the surface soils are sandy loams. Buried soils are thin to moderately thick, nongravelly to gravelly, sandy loams or loams. This soil is well drained. Permeability is rapid.

Bedrock is composed of moderately competent (locally incompetent), moderately hard (soft near the surface) granodiorite rock. Depth to bedrock ranges from 20 to 34 inches.

Range of Profile Characteristics of Soil 134

Litter:	Needles, leaves, twigs and decomposing organic matter. ½ to 1½ inches thick.
Surface Layers: 2/	Light yellowish brown to brown, silt loam; single grained or weak, fine, subangular blocky structure; 0 to 10 percent subangular gravel by volume; nonsticky, nonplastic; pH ranges from 5.5 to 6.5; 4 to 12 inches thick.
Subsoil Layers:	Dark reddish brown to pale brown, nongravelly to gravelly, sandy loam to sand; single grained; 5 to 45 percent subangular gravel and cobbles by volume; nonsticky, nonplastic; pH ranges from 6.0 to 7.0; 12 to 30 inches thick.

1/ A predominance of white fir, Douglas-fir and western larch with ponderosa pine or lodgepole pine sometimes common.

2/ Locally, ash is less than 4 inches thick or absent. Surface soils are most commonly sandy loams or loams under these conditions.

MAPPING UNIT 135

Landtype 135 occurs on steep, nondissected to slightly dissected sideslopes of greater than 35 percent. This landtype ranges in elevation from 3600 to 5500 feet and supports ponderosa pine stands.

Mapping Unit 135 consists dominantly of landtype 135 and minor amounts of landtype 133 which supports an associated species stand, landtype 136 which occurs on dissected slopes and landtype 144 which occurs on gentle slopes.

Soil 135 is a shallow to moderately deep, nonplastic soil derived from residuum and colluvium. Surface soils are thin, nongravelly to gravelly, sandy loams or loamy sands. Subsoils are thin to moderately thick, nongravelly to gravelly, sands, loamy sands of sandy loams. This soil is well drained. Permeability is rapid.

Bedrock is composed of moderately competent, moderately hard to soft, granodiorite rock. Depth to bedrock ranges from 16 to 40 inches.

Range of Profile Characteristics of Soil 135

Litter:	Needles, leaves, twigs and decomposing organic matter. ½ to 1 inch thick.
Surface Layers:	Dark yellowish brown to dark brown, nongravelly to gravelly, sandy loam to loamy sand; single grained; 0 to 45 percent subangular or subrounded gravel by volume; nonsticky, nonplastic; pH ranges from 6.0 to 7.0; 6 to 20 inches thick.
Subsoil Layers:	Dark yellowish brown to reddish brown, nongravelly to very gravelly, sandy loam to sand; single grained; 5 to 55 percent subangular or subrounded gravel and cobbles by volume; nonsticky, nonplastic; pH ranges from 6.5 to 7.0; 4 to 34 inches thick.

MAPPING UNIT 136

Landtype 136 occurs on steep, dissected sideslopes of greater than 35 percent. This landtype ranges in elevation from 3600 to 5500 feet and supports ponderosa pine stands.

Mapping Unit 136 consists dominantly of landtype 136 and minor amounts of landtype 134 which supports an associated species stand and landtype 135 which occurs on nondissected to slightly dissected slopes.

Soil 136 is a shallow to moderately deep, nonplastic soil derived from residuum and colluvium. Surface soils are thin, nongravelly to gravelly, sandy loams or loamy sands. Subsoils are thin to moderately thick, nongravelly to gravelly, sands, loamy sands or sandy loams. This soil is well drained. Permeability is rapid.

Bedrock is composed of moderately competent, moderately hard to soft, granodiorite rock. Depth to bedrock ranges from 16 to 40 inches.

Range of Profile Characteristics of Soil 136

Litter:	Needles, leaves, twigs and decomposing organic matter. ½ to 1 inch thick.
Surface Layers:	Dark yellowish brown to dark brown, nongravelly to gravelly, sandy loam to loamy sand; single grained; 0 to 45 percent subangular or subrounded to gravel by volume; nonsticky, nonplastic; pH ranges from 6.0 to 7.0; 6 to 20 inches thick.
Subsoil Layers:	Dark yellowish brown to reddish brown, nongravelly to very gravelly, sandy loam to sand; single grained; 5 to 55 percent subangular or subrounded gravel and cobbles by volume; nonsticky, nonplastic; pH ranges from 6.5 to 7.0; 4 to 34 inches thick.

MAPPING UNIT 137

Landtype 137 occurs on steep, slightly dissected to dissected sideslopes and toeslopes of greater than 35 percent. This landtype ranges in elevation from 4000 to 5000 feet and supports an associated species stand 1/ or ponderosa pine/Douglas-fir stands.

Mapping Unit 137 consists dominantly of landtype 137 and minor amounts of landtypes 133 and 134 which have less deep soils.

Soil 137 is a very deep, nonplastic soil derived from aeolian deposits and buried colluvium. Surface soils are thin silt loam ash deposits. Buried soils are very thick, cobbly and stony sandy loams, loamy sands and sands. This soil is well drained. Permeability is rapid.

Bedrock is composed of moderately competent to incompetent, moderately hard to soft granodiorite rock. Depth to bedrock is greater than 60 inches.

Range of Profile Characteristics of Soil 137

Litter:	Needles, leaves, twigs and decomposing organic matter. ½ to 1½ inches thick.
Surface Layers:	Dark yellowish brown to dark brown, silt loam; single grained to weak, fine, subangular blocky structure; 0 to 10 percent subangular gravel by volume; nonsticky, nonplastic; pH ranges from 5.5 to 6.5; 4 to 22 inches thick.
Buried Layers:	Dark brown to gray, gravelly and cobbly, sand to sandy loam; single grained or massive; 35 to 55 percent subrounded gravel, cobbles and stones by volume; nonsticky, nonplastic; pH ranges from 6.0 to 7.0; greater than 56 inches thick.

1/ A predominance of white fir, Douglas-fir and western larch with ponderosa pine and lodgepole pine sometimes common.

MAPPING UNIT 141

Landtype 141 occurs on gentle ridgetops and benches of less than 35 percent slope. This landtype ranges in elevation from 5600 to 7300 feet and supports an upper forest association 1/.

Mapping Unit 141 consists dominantly of landtype 141 and minor amounts of landtype 142 which supports lodgepole pine, landtype 143 which supports an associated species stand and landtype 131 which occurs on steep slopes.

Soil 141 is a shallow to moderately deep, nonplastic soil derived from aeolian deposits and buried residuum. Surface soils are thin, silt loam ash deposits. Buried soils are thin to moderately thick, nongravelly to gravelly, sandy loams or loamy sands. This soil is well drained. Permeability is rapid.

Bedrock is composed of moderately competent to competent, moderately hard granodiorite rock. Depth to bedrock ranges from 16 to 40 inches.

Range of Profile Characteristics of Soil 141

Litter:	Needles, leaves, twigs and decomposing organic matter. ½ to 1½ inches thick.
Surface Layers:	Light yellowish brown to dark brown, silt loam; single grained to weak, fine, subangular blocky structure; 0 to 5 percent subangular or subrounded gravel by volume; nonsticky, nonplastic; pH ranges from 5.5 to 6.5; 4 to 20 inches thick.
Buried Layers:	Dark reddish brown to grayish brown, nongravelly to gravelly, sandy loam to sand; single grained; 5 to 45 percent subangular or subrounded gravel and cobbles by volume; nonsticky, nonplastic; pH ranges from 5.5 to 7.0; 8 to 36 inches thick.

1/ A predominance of Engelmann spruce, subalpine fir and lodgepole pine with white fir and western larch sometimes common.

MAPPING UNIT 142

Landtype 142 occurs on gentle ridgetops and benches of less than 35 percent slope. This landtype ranges in elevation from 3500 to 6500 feet and supports lodgepole pine stands.

Mapping Unit 142 consists dominantly of landtype 142 and minor amounts of landtype 141 which supports an upper forest association, landtype 143 which supports an associated species stand and landtype 132 which occurs on steep slopes.

Soil 142 is a shallow to moderately deep, nonplastic soil derived from aeolian deposits and buried residuum. Surface soils are thin, silt loam ash deposits. Buried soils are thin to moderately thick, non-gravelly to gravelly, sandy loams or loamy sands. This soil is well drained. Permeability is rapid.

Bedrock is composed of moderately competent to competent, moderately hard granodiorite rock. Depth to bedrock ranges from 16 to 40 inches.

Range of Profile Characteristics of Soil 142

Litter:	Needles, leaves, twigs and decomposing organic matter. ½ to 1½ inches thick.
Surface Layers:	Light yellowish brown to dark brown, silt loam; single grained to weak, fine, subangular blocky structure; 0 to 5 percent subangular or subrounded gravel by volume; nonsticky, nonplastic; pH ranges from 5.5 to 6.5; 4 to 20 inches thick.
Buried Layers:	Dark reddish brown to grayish brown, nongravelly to gravelly, sandy loam to sand; single grained; 5 to 45 percent subangular or subrounded gravel and cobbles by volume; nonsticky, nonplastic; pH ranges from 5.5 to 7.0; 8 to 36 inches thick.

MAPPING UNIT 143

Landtype 143 occurs on gentle ridgetops and benches of less than 35 percent slope. This landtype ranges in elevation from 3500 to 6500 feet and supports an associated species stand 1/.

Mapping Unit 143 consists dominantly of landtype 143 and minor amounts of landtype 141 which supports an upper forest association, landtype 142 which supports lodgepole pine, landtype 144 which supports ponderosa pine stands and landtype 133 which occurs on steep slopes.

Soil 143 is a shallow to moderately deep (locally deep), nonplastic soil derived from aeolian deposits and buried residuum. Surface soils are thin, silt loam ash deposits. Buried soils are thin to moderately thick, nongravelly to gravelly, sandy loams or loamy sands. This soil is well drained. Permeability is rapid.

Bedrock is composed of incompetent to moderately competent, soft granodiorite rock. Depth to bedrock ranges from 20 to 40 inches (locally to 70 inches).

Range of Profile Characteristics of Soil 143

Litter:	Needles, leaves, twigs and decomposing organic matter. ½ to 1½ inches thick.
Surface Layers: 2/	Light yellowish brown to dark brown, silt loam; single grained to weak, fine, subangular blocky structure; 0 to 5 percent subangular or subrounded gravel by volume; nonsticky, nonplastic; pH ranges from 5.5 to 6.5; 4 to 18 inches thick.
Buried Layers:	Dark reddish brown to grayish brown, nongravelly to gravelly, loam to sand; single grained; 5 to 45 percent subangular or subrounded gravel and cobbles by volume; nonsticky, nonplastic; pH ranges from 5.5 to 7.0; 8 to 36 inches thick.

1/ A predominance of white fir, western larch and Douglas-fir with Engelmann spruce, ponderosa pine and lodgepole pine sometimes common.

2/ Locally, ash is absent or less than 4 inches thick. Surface soils are generally sandy loams or loams under these conditions.

MAPPING UNIT 144

Landtype 144 occurs on gentle ridgetops and benches of less than 35 percent slope. This landtype ranges in elevation from 3600 to 5500 feet and supports ponderosa pine stands.

Mapping Unit 144 consists dominantly of landtype 144 and minor amounts of landtype 143 which supports an associated species stand and landtype 135 which occurs on steep slopes.

Soil 144 is a shallow to moderately deep, nonplastic soil derived from aeolian deposits and/or residuum. Surface soils are generally thin, silt loam ash deposits. Buried soils are thin to moderately thick, nongravelly, loamy sands or sandy loams. This soil is well drained. Permeability is rapid.

Bedrock is composed of moderately competent to competent, moderately hard granodiorite rock. Depth to bedrock ranges from 20 to 40 inches.

Range of Profile Characteristics of Soil 144

Litter:	Needles, leaves, twigs and decomposing organic matter. 0 to 1½ inches thick.
Surface Layers: 1/	Dark brown to brown, silt loam; single grained to weak, fine, subangular blocky structure; 0 to 5 percent subangular or subrounded gravel by volume; nonsticky, nonplastic; pH ranges from 6.0 to 6.5; 4 to 16 inches thick.
Buried Layers:	Dark brown to light yellowish brown or grayish brown, nongravelly, loamy sand to loam; single grained; 0 to 30 percent subangular or subrounded gravel and cobbles by volume; nonsticky, nonplastic; pH ranges from 6.0 to 7.0; 8 to 38 inches thick.

1/ Locally, ash is absent or less than 4 inches thick. Surface soils are generally sandy loams or loams under these conditions.

MAPPING UNIT 145

Landtype 145 occurs on gentle, concave, even to somewhat uneven valley bottom areas and toeslopes of less than 35 percent slope. This landtype ranges in elevation from 3500 to 4600 feet and supports an associated species stand 1/. Locally, ponderosa pine stands occur.

Mapping Unit 145 consists dominantly of landtype 145 and minor amounts of landtype 143 which occurs on convex topography and landtype 146 which supports lodgepole pine stands.

Soil 145 is a moderately deep to deep, nonplastic soil derived from aeolian deposits and buried residuum. Surface soils are thin, silt loam ash deposits. Buried soils are moderately thick to thick, loamy sands or sandy loams. This soil is well drained. Permeability is rapid.

Bedrock is composed of moderately competent to incompetent, moderately hard to soft granodiorite rock. Depth to bedrock ranges from 40 to 70 inches.

Range of Profile Characteristics of Soil 145

Litter:	Needles, leaves, twigs and decomposing organic matter. ½ to 2 inches thick.
Surface Layers:	Light yellowish brown to dark brown, silt loam; single grained to weak, fine, subangular blocky structure; 0 to 5 percent subrounded gravels by volume; nonsticky, nonplastic; pH ranges from 5.5 to 6.5; 8 to 22 inches thick.
Buried Layers:	Dark reddish brown to grayish brown, loamy sands to sandy loams; single grained; 0 to 30 percent subangular or subrounded gravel and cobbles by volume; nonsticky, nonplastic; pH ranges from 5.5 to 7.0; 18 to 50 inches thick.

1/ A predominance of white fir, western larch and Douglas-fir with Engelmann spruce and lodgepole pine sometimes common.

MAPPING UNIT 146

Landtype 146 occurs on gentle, concave, even to somewhat uneven valley bottom areas and toeslopes of less than 35 percent slope. This landtype ranges in elevation from 3500 to 4600 feet and supports lodgepole pine stands.

Mapping Unit 146 consists dominantly of landtype 146 and minor amounts of landtype 142 which occurs on convex topography and supports an associated species stand and landtype 145 which supports an associated species stand.

Soil 146 is a moderately deep to deep, nonplastic soil derived from aeolian deposits and buried residuum. Surface soils are thin, silt loam ash deposits. Buried soils are moderately thick to thick, loamy sands or sandy loams. This soil is well drained. Permeability is rapid.

Bedrock is composed of moderately competent to incompetent, moderately hard to soft granodiorite rock. Depth to bedrock ranges from 40 to 70 inches.

Range of Profile Characteristics of Soil 146

Litter:	Needles, leaves, twigs and decomposing organic matter. ½ to 2 inches thick.
Surface Layers:	Light yellowish brown to dark brown, silt loam; single grained to weak, fine, subangular blocky structure; 0 to 5 percent subrounded gravels by volume; nonsticky, nonplastic; pH ranges from 5.5 to 6.5; 8 to 22 inches thick.
Buried Layers:	Dark reddish brown to grayish brown, loamy sands to sandy loams; single grained; 0 to 30 percent subangular or subrounded gravel and cobbles by volume; nonsticky, nonplastic; pH ranges from 5.5 to 7.0; 18 to 50 inches thick.

MAPPING UNIT 147

Landtype 147 occurs on gentle, concave, somewhat uneven to uneven, slightly dissected to dissected slopes of less than 35 percent. This landtype ranges in elevation from 4200 to 5600 feet and supports an associated species stand 1/.

Mapping Unit 147 consists dominantly of landtype 147 and minor amounts of landtype 143 which occurs on convex topography and landtypes 133 and 134 which occur on steep slopes.

Soil 147 is a deep to very deep, nonplastic to plastic soil derived from aeolian deposits and/or residuum. Surface soils are generally, thin, loams or silt loams with locally ash deposits present to 18 inches. Subsoils are thick to very thick, gravelly to very gravelly, loams or sandy clay loams. This soil is moderately well to imperfectly drained. Permeability is rapid in the surface soils and moderate to slow in the subsoils.

Bedrock is composed of incompetent, soft granodiorite rock. Depth to bedrock is greater than 60 inches.

Range of Profile Characteristics of Soil 147

Litter:	Needles, leaves, twigs and decomposing organic matter. ½ to 2 inches thick.
Surface Layers: 2/	Dark brown to yellowish brown, loam to silt loam; single grained to weak, fine, subangular blocky structure; 5 to 35 percent subrounded gravel by volume; nonsticky to slightly sticky, nonplastic; pH ranges from 6.0 to 7.0; 8 to 24 inches thick.
Subsoil Layers:	Dark yellowish brown to brown, loam to sandy clay loam; massive; 5 to 35 percent subangular or subrounded gravel, cobbles and stones by volume; nonsticky to sticky, nonplastic to slightly plastic; pH ranges from 6.0 to 7.0; 52 to 120 inches thick.

1/ A predominance of white fir, western larch and Douglas-fir with Engelmann spruce, ponderosa pine and lodgepole pine sometimes common.

2/ Locally, ash deposits may be present.

MAPPING UNIT 150

Mapping Unit 150 consists primarily of gabbro, meta-gabbro, granitic gneiss and some altered coarse grained sedimentary rock outcrops with inclusions of soil. The most common inclusions are Landtype 5, 151, 152, 153 and 154.

Bedrock is generally hard and competent.

This mapping unit occurs on ridgecrests and steep sideslopes.

MAPPING UNIT 151

Landtype 151 occurs on steep, nondissected to slightly dissected sideslopes of greater than 35 percent. This landtype ranges in elevation from 5700 to 6400 feet and supports an upper forest association 1/.

Mapping Unit 151 consists dominantly of landtype 151 and minor amounts of landtype 152 which supports an associated species stand and landtype 155 which occurs on gentle slopes.

Soil 151 is a shallow to moderately deep, nonplastic soil derived from colluvium, residuum and locally, aeolian deposits. Surface soils are generally thin, loams or silt loams. Locally, surface soils are of silt loam ash deposits. Subsoils are generally thin to moderately thick, gravelly to nongravelly, sandy loams or loams. This soil is well drained. Permeability is rapid.

Bedrock is composed of competent to moderately competent, hard to moderately hard, metamorphosed intrusive or coarse grained sedimentary rock. Depth to bedrock ranges from 12 to 40 inches.

Range of Profile Characteristics of Soil 151

Litter:	Needles, leaves, twigs and decomposing organic matter. ½ to 1 inch thick.
Surface Layers: 2/	Dark brown to reddish gray, loam to silt loam; single grained or weak, fine, subangular blocky structure; 5 to 30 percent subangular or angular gravel by volume; nonsticky, nonplastic; pH ranges from 5.5 to 7.0; 4 to 16 inches thick.
Subsoil Layers:	Yellowish brown to dark brown, nongravelly to gravelly, sandy loam to silt loam; single grained or weak, fine or very fine, subangular blocky structure; 10 to 45 percent subangular or angular gravel, cobbles and stones by volume; nonsticky to slightly sticky, nonplastic to slightly plastic; pH ranges from 5.5 to 6.5; 8 to 36 inches thick.

1/ A predominance of subalpine fir, Engelmann spruce and lodgepole pine with white fir and western larch sometimes common.

2/ Locally, surface soils are silt loam ash deposits.

MAPPING UNIT 152

Landtype 152 occurs on steep, nondissected to slightly dissected sideslopes of greater than 35 percent. This landtype ranges in elevation from 3600 to 5800 feet and supports an associated species stand 1/.

Mapping Unit 152 consists dominantly of landtype 152 and minor amounts of landtype 151 which supports an upper forest association, landtype 153 which occurs on steep, dissected sideslopes, landtype 154 which supports ponderosa pine and landtype 157 which occurs on gentle slopes.

Soil 152 is a shallow to moderately deep, nonplastic soil derived from colluvium, residuum and locally, aeolian deposits. Surface soils are generally thin, loams or silt loams. Locally, surface soils are of silt loam ash deposits. Subsoils are generally thin to moderately thick, gravelly to nongravelly, sandy loams or loams. This soil is well drained. Permeability is rapid.

Bedrock is composed of competent ot moderately competent, hard to moderately hard, metamorphosed intrusive or coarse grained sedimentary rock. Depth to bedrock ranges from 12 to 40 inches.

Range of Profile Characteristics of Soil 152

Litter:	Needles, leaves, twigs and decomposing organic matter. ½ to 1 inch thick.
Surface Layers: 2/	Dark brown to reddish gray, loam to silt loam; single grained or weak, fine, subangular blocky structure; 5 to 30 percent subangular or angular gravel by volume; nonsticky, nonplastic; pH ranges from 5.5 to 7.0; 4 to 16 inches thick.
Subsoil Layers:	Yellowish brown to dark brown, nongravelly to gravelly, sandy loam to silt loam; single grained, massive or weak, fine or very fine, subangular blocky structure; 10 to 45 percent subangular or angular gravel, cobbles and stones by volume; nonsticky to slightly sticky, nonplastic to slightly plastic; pH ranges from 5.5 to 7.0; 8 to 34 inches thick.

1/ A predominance of white fir, western larch and Douglas-fir with ponderosa pine and lodgepole pine sometimes common.

MAPPING UNIT 153

Landtype 153 occurs on steep, dissected sideslopes of greater than 35 percent. This landtype ranges in elevation from 3800 to 5800 feet and supports an associated species stand 1/.

Mapping Unit 153 consists dominantly of landtype 153 and minor amounts of landtype 152 which occurs on steep, nondissected to slightly dissected slopes.

Soil 153 is a shallow to moderately deep, nonplastic soil derived from colluvium, residuum and locally, aeolian deposits. Surface soils are generally thin, loams or silt loams. Locally, surface soils are of silt loam ash deposits. Subsoils are generally thin to moderately thick, gravelly to nongravelly, sandy loams or loams. This soil is well drained. Permeability is rapid.

Bedrock is composed of competent to moderately competent, hard to moderately hard, metamorphosed intrusive or coarse grained sedimentary rock. Depth to bedrock ranges from 12 to 40 inches.

Range of Profile Characteristics of Soil 153

Litter:	Needles, leaves, twigs and decomposing organic matter. ½ to 1 inch thick.
Surface Layers: 2/	Dark brown to reddish gray, loam to silt loam; single grained or weak, fine, subangular blocky structure; 5 to 30 percent subangular or angular gravel by volume; nonsticky, nonplastic; pH ranges from 5.5 to 7.0; 4 to 16 inches thick.
Subsoil Layers:	Yellowish brown to dark brown, nongravelly to gravelly, sandy loam to silt loam; single grained, massive or weak, fine or very fine, subangular blocky structure; 10 to 45 percent subangular or angular gravel, cobbles and stones by volume; nonsticky to slightly sticky, nonplastic to slightly plastic; pH ranges from 5.5 to 6.5; 8 to 36 inches thick.

1/ A predominance of white fir, western larch and Douglas-fir with ponderosa pine, lodgepole pine and Engelmann spruce sometimes common.

2/ Locally, surface soils are silt loam ash deposits.

MAPPING UNIT 154

Landtype 154 occurs on steep, nondissected to slightly dissected sideslopes of greater than 35 percent. This landtype ranges in elevation from 3600 to 5400 feet and supports ponderosa pine stands.

Mapping Unit 154 consists dominantly of landtype 154 and minor amounts of landtype 152 which supports an associated species stand and landtype 158 which occurs on gentle slopes.

Soil 154 is a shallow to moderately deep, nonplastic soil derived from colluvium and residuum. Surface soils are generally thin, sandy loams or silt loams. Subsoils are thin, sandy loams or loams. This soil is well drained. Permeability is rapid.

Bedrock is composed of competent to moderately competent, hard to moderately hard, metamorphosed intrusive or coarse grained sedimentary rock. Depth to bedrock ranges from 12 to 36 inches.

Range of Profile Characteristics of Soil 154

Litter:	Needles, leaves, twigs and decomposing organic matter. 0 to ½ inch thick.
Surface Layers:	Grayish brown to dark brown, nongravelly, sandy loam to silt loam; single grained or weak, fine or very fine, subangular blocky structure; 5 to 30 percent subangular or angular gravel by volume; nonsticky, nonplastic; pH ranges from 5.5 to 6.5; 2 to 16 inches thick.
Subsoil Layers:	Yellowish brown to dark brown, nongravelly to gravelly, sandy loam to loam; single grained or weak, fine or very fine, subangular blocky structure; 5 to 45 percent subangular or angular gravel, cobbles and stones by volume; nonsticky, nonplastic; pH ranges from 5.5 to 6.5; 8 to 34 inches thick.

MAPPING UNIT 155

Landtype 155 occurs on gentle ridgetops or benches of less than 35 percent slope. This landtype ranges in elevation from 5700 to 6400 feet and supports an upper forest association 1/.

Mapping Unit 155 consists dominantly of landtype 155 and minor amounts of landtype 156 which supports lodgepole pine, landtype 157 which supports an associated species stand and landtype 151 which occurs on steep slopes.

Soil 155 is a shallow to moderately deep, nonplastic soil derived from aeolian deposits and/or residuum. Surface soils are generally thin, loams. Locally, silt loam ash deposits may occur. Subsoils are thin to moderately thick, gravelly to nongravelly, sandy loams or loams. This soil is well drained. Permeability is rapid.

Bedrock is composed of competent to moderately competent, hard to moderately hard, metamorphosed intrusive or coarse grained sedimentary rock. Depth to bedrock ranges from 12 to 40 inches.

Range of Profile Characteristics of Soil 155

Litter:	Needles, leaves, twigs and decomposing organic matter. ½ to 1 inch thick.
Surface Layers: 2/	Dark brown to reddish gray, loam to silt loam; single grained or weak, fine, subangular blocky structure; 5 to 30 percent subangular or angular gravel by volume; nonsticky, nonplastic; pH ranges from 5.5 to 7.0; 4 to 16 inches thick.
Subsoil Layers:	Yellowish brown to dark brown, nongravelly to gravelly, sandy loam to silt loam; single grained or weak, fine or very fine, subangular blocky structure; 10 to 45 percent subangular or angular gravel, cobbles and stones by volume; nonsticky to slightly sticky, nonplastic to slightly plastic; pH ranges from 5.5 to 6.5; 8 to 36 inches thick.

1/ A predominance of subalpine fir, Engelmann spruce and lodgepole pine with white fir and western larch sometimes common.

2/ Locally, surface soils are silt loam ash deposits.

MAPPING UNIT 156

Landtype 156 occurs on gentle ridgetops or benches of less than 35 percent. This landtype ranges in elevation from 5200 to 6400 feet and supports lodgepole pine.

Mapping Unit 156 consists dominantly of landtype 156 and minor amounts of landtype 155 which supports an upper forest association and landtype 157 which supports an associated species stand.

Soil 156 is a shallow to moderately deep, nonplastic soil derived from colluvium, residuum and locally, aeolian deposits. Surface soils are generally thin, loams or silt loams. Locally, surface soils are of silt loam ash deposits. Subsoils are generally thin to moderately thick, gravelly to nongravelly, sandy loams or loams. This soil is well drained. Permeability is rapid.

Bedrock is composed of competent to moderately competent, hard to moderately hard, metamorphosed intrusive or coarse grained sedimentary rock. Depth to bedrock ranges from 12 to 40 inches.

Range of Profile Characteristics of Soil 156

Litter:	Needles, leaves, twigs and decomposing organic matter. ½ to 1 inch thick.
Surface Layers: 1/	Dark brown to reddish gray, loam to silt loam; single grained or weak, fine, subangular blocky structure; 5 to 30 percent subangular or angular gravel by volume; nonsticky, nonplastic; pH ranges from 5.5 to 7.0; 4 to 16 inches thick.
Subsoil Layers:	Yellowish brown to dark brown, nongravelly to gravelly, sandy loam to silt loam; single grained or weak, fine or very fine, subangular blocky structure; 10 to 45 percent subangular or angular gravel, cobbles and stones by volume; nonsticky to slightly sticky, nonplastic to slightly plastic; pH ranges from 5.5 to 6.5; 8 to 36 inches thick.

1/ Locally, surface soils are silt loam ash deposits.

MAPPING UNIT 157

Landtype 157 occurs on gentle ridgetops and benches of less than 35 percent slope. This landtype ranges in elevation from 3600 to 5700 feet and supports an associated species stand 1/.

Mapping Unit 157 consists dominantly of landtype 157 and minor amounts of landtype 155 which supports an upper forest association, landtype 158 which supports ponderosa pine and landtype 152 which occurs on steep slopes.

Soil 157 is a shallow to moderately deep, nonplastic soil derived from aeolian deposits and/or residuum. Surface soils are generally thin, sandy loams or loams. Locally, silt loam ash deposits may occur. Subsoils are thin to moderately thick, gravelly to nongravelly, sandy loams or loams. This soil is well drained. Permeability is rapid.

Bedrock is composed of competent to moderately competent, hard to moderately hard, metamorphosed intrusive or coarse grained sedimentary rock. Depth to bedrock ranges from 12 to 40 inches.

Range of Profile Characteristics of Soil 157

Litter:	Needles, leaves, twigs and decomposing organic matter. ½ to 1 inch thick.
Surface Layers: 2/	Dark brown to reddish gray, sandy loam to silt loam; single grained or weak, fine, subangular blocky structure; 5 to 30 percent subangular or angular gravel by volume; nonsticky, nonplastic; pH ranges from 5.5 to 7.0; 4 to 16 inches thick.
Subsoil Layers:	Yellowish brown to dark brown, nongravelly to gravelly, sandy loam to silt loam; single grained or weak, fine or very fine, subangular blocky structure; 10 to 45 percent subangular or angular gravel, cobbles and stones by volume; nonsticky to slightly sticky, nonplastic to slightly plastic; pH ranges from 5.5 to 6.5; 8 to 36 inches thick.

1/ A predominance of white fir, Douglas-fir and western larch with ponderosa pine and lodgepole pine sometimes common.

2/ Locally, surface soils are silt loam ash deposits.

MAPPING UNIT 158

Landtype 158 occurs on gentle ridgetops or benches of less than 35 percent slope. This landtype ranges in elevation from 3600 to 5400 feet and supports ponderosa pine.

Mapping Unit 158 consists dominantly of landtype 158 and minor amounts of landtype 157 which supports an associated species stand and landtype 154 which occurs on steep slopes.

Soil 158 is a shallow to moderately deep, nonplastic soil derived from residuum. Surface soils are thin, sandy loams or loams. Subsoils are thin to moderately thick, gravelly to nongravelly, sandy loams or loams. This soil is well drained. Permeability is rapid.

Bedrock is composed of competent to moderately competent, hard to moderately hard, metamorphosed intrusive or coarse grained sedimentary rock. Depth to bedrock ranges from 12 to 40 inches.

Range of Profile Characteristics of Soil 158

Litter:	Needles, leaves, twigs and decomposing organic matter. 0 to ½ inch thick.
Surface Layers:	Grayish brown to dark brown, sandy loam to silt loam; single grained or weak, fine or very fine, subangular blocky structure; 5 to 35 percent subangular or angular gravel by volume; nonsticky, nonplastic; pH ranges from 5.5 to 6.5; 2 to 16 inches thick.
Subsoil Layers:	Yellowish brown to dark brown, nongravelly to gravelly, loamy sand to loam; single grained or weak, fine or very fine, subangular blocky structure; 5 to 45 percent subangular or angular gravel, cobbles and stones by volume; nonsticky, nonplastic; pH ranges from 5.5 to 6.5; 6 to 34 inches thick.

MAPPING UNIT 160

Mapping Unit 160 consists primarily of argillite along with minor limestone and other fine grained metamorphic rock outcrops with inclusions of soils. The most common inclusions are Landtypes 5, 161, 162, 163, 164 and 165.

Bedrock is generally competent and highly fractured.

This mapping unit occurs on ridgecrests and steep sideslopes.

MAPPING UNIT 161

Landtype 161 occurs on steep, nondissected to slightly dissected sideslopes of greater than 35 percent. This landtype ranges in elevation from 3600 to 5400 feet and supports lodgepole pine stands. Locally, this landtype supports an upper forest association at higher elevations.

Mapping Unit 161 consists dominantly of landtype 161 and minor amounts of landtype 162 which supports an associated species stand and landtype 166 which occurs on gentle slopes.

Soil 161 is a shallow to moderately deep, nonplastic to slightly plastic soil derived from aeolian deposits and/or residuum and colluvium. Surface soils are generally thin, nongravelly or gravelly, silt loams or loams. Locally, silt loam ash deposits occur. Subsoils are generally thin to moderately thick, gravelly to very gravelly, sandy loams, loams or clay loams. This soil is well drained. Permeability is rapid.

Bedrock is composed of competent to moderately competent, hard to moderately hard, very highly fractured, fine grained sedimentary or metasedimentary rock. Depth to bedrock ranges from 12 to 36 inches.

Range of Profile Characteristics of Soil 161

Litter:	Needles, leaves, twigs and decomposing organic matter. ½ to 1½ inches thick.
Surface Layers: 1/	Yellowish brown to dark brown, sandy loam to silt loam; single grained or weak, fine, subangular blocky structure; 5 to 35 percent angular gravel by volume; nonsticky, nonplastic; pH ranges from 5.5 to 6.5; 4 to 12 inches thick.
Subsoil Layers:	Grayish brown to very dark brown, gravelly to very gravelly, sandy loam to clay loam; single grained, massive or weak, fine, subangular blocky structure; 35 to 75 percent gravel and cobbles by volume; nonsticky to slightly sticky, nonplastic to slightly plastic; pH ranges from 5.5 to 6.5; 8 to 32 inches thick.

1/ Locally, surface soils are silt loam ash deposits.

MAPPING UNIT 162

Landtype 162 occurs on steep, nondissected to slightly dissected sideslopes of greater than 35 percent. This landtype ranges in elevation from 3600 to 5600 feet and supports an associated species stand 1/.

Mapping Unit 162 consists dominantly of landtype 162 and minor amounts of landtype 161 which supports lodgepole pine, landtype 163 which occurs on steep dissected sideslopes, landtype 164 which supports ponderosa pine and landtype 167 which occurs on gentle slopes.

Soil 162 is a shallow to moderately deep, nonplastic to slightly plastic soil derived from aeolian deposits and/or residuum and colluvium. Surface soils are generally thin, nongravelly or gravelly, silt loams or loams. Locally, silt loam ash deposits occur. Subsoils are generally thin to moderately thick, gravelly to very gravelly, sandy loams, loams or clay loams. This soil is well drained. Permeability is rapid.

Bedrock is composed of competent to moderately competent, hard to moderately hard, very highly fractured, fine grained sedimentary or metasedimentary rock. Depth to bedrock ranges from 12 to 36 inches.

Range of Profile Characteristics of Soil 162

Litter:	Needles, leaves, twigs and decomposing organic matter. ½ to 1½ inches thick.
Surface Layers: 2/	Yellowish brown to dark brown, nongravelly to gravelly, sandy loam to silt loams; single grained or weak, fine, subangular blocky structure; 5 to 45 percent subangular or angular gravel by volume; nonsticky, nonplastic; pH ranges from 5.5 to 6.5; 4 to 12 inches thick.
Subsoil Layers:	Grayish brown to very dark brown, gravelly to very gravelly, sandy loam to clay loam; single grained, massive or weak, fine, subangular blocky structure; 35 to 75 percent subangular or angular gravel and cobbles by volume; nonsticky to slightly sticky, nonplastic to slightly plastic; pH ranges from 5.5 to 6.5; 8 to 32 inches thick.

1/ A predominance of white fir, Douglas-fir and western larch with ponderosa pine, lodgepole pine and Engelmann spruce sometimes common.

2/ Locally, surface soils are silt loam ash deposits.

MAPPING UNIT 163

Landtype 163 occurs on steep, dissected sideslopes of greater than 35 percent. This landtype ranges in elevation from 3600 to 5600 feet and supports an associated species stand 1/.

Mapping Unit 163 consists dominantly of landtype 163 and minor amounts of landtype 162 which occurs on steep, nondissected to slightly dissected slopes and landtype 165 which supports ponderosa pine.

Soil 163 is a shallow to moderately deep, nonplastic to slightly plastic soil derived from aeolian deposits and/or residuum and colluvium. Surface soils are generally thin, nongravelly or gravelly, silt loams or loams. Locally, silt loam ash deposits occur. Subsoils are generally thin to moderately thick, gravelly to very gravelly, sandy loams, loams or clay loams. This soil is well drained. Permeability is rapid.

Bedrock is composed of competent to moderately competent, hard to moderately hard, very highly fractured, fine grained sedimentary or metasedimentary rock. Depth to bedrock ranges from 12 to 36 inches.

Range of Profile Characteristics of Soil 163

Litter:	Needles, leaves, twigs and decomposing organic matter. ½ to 1½ inches thick.
Surface Layers: 2/	Yellowish brown to dark brown, nongravelly to gravelly, sandy loam to silt loam; single grained or weak, fine, subangular blocky structure; 5 to 35 percent subangular or angular gravel by volume; nonsticky, nonplastic; pH ranges from 5.5 to 6.5; 4 to 12 inches thick.
Subsoil Layers:	Grayish brown to very dark brown, gravelly to very gravelly, sandy loam to clay loam; single grained, massive or weak, fine, subangular blocky structure; 35 to 75 percent subangular or angular gravel and cobbles by volume; nonsticky to slightly sticky, nonplastic to slightly plastic; pH ranges from 5.5 to 6.5; 8 to 32 inches thick.

1/ A predominance of white fir, Douglas-fir and western larch with ponderosa pine, lodgepole pine and Engelmann spruce sometimes common.

2/ Locally, surface soils are silt loam ash deposits.

MAPPING UNIT 164

Landtype 164 occurs on steep, nondissected to slightly dissected sideslopes of greater than 35 percent. This landtype ranges in elevation from 3600 to 5400 feet and supports ponderosa pine stands.

Mapping Unit 164 consists dominantly of landtype 164 and minor amounts of landtype 162 which supports an associated species stand, landtype 165 which occurs on steep, dissected sideslopes and landtype 168 which occurs on gentle slopes.

Soil 164 is a shallow to moderately deep, nonplastic to slightly plastic soil derived from residuum and colluvium. Surface soils are thin, nongravelly to gravelly, loams or silt loams. Subsoils are generally thin, gravelly, loams or silt loams. This soil is well drained. Permeability is rapid.

Bedrock is composed of competent, hard to moderately hard, very highly fractured, fine grained sedimentary or metasedimentary rock. Depth to bedrock ranges from 10 to 24 inches.

Range of Profile Characteristics of Soil 164

Litter:	Needles, leaves, twigs and decomposing organic matter. 0 to 1 inch thick.
Surface Layers:	Brown to dark reddish brown, nongravelly to gravelly, loam to silt loam; single grained or weak to moderate, fine, subangular blocky structure; 10 to 45 percent subangular or angular gravel and cobbles by volume; nonsticky to slightly sticky, nonplastic to slightly plastic; pH ranges from 6.0 to 7.0; 6 to 20 inches thick.
Subsoil Layers:	Grayish brown to very dark brown, gravelly to very gravelly, sandy loam to silt loam; single grained or weak, fine, subangular blocky structure; 35 to 75 percent subangular or angular gravel and cobbles by volume; nonsticky to slightly sticky, nonplastic to slightly plastic; pH ranges from 5.5 to 6.5; 2 to 18 inches thick.

MAPPING UNIT 165

Landtype 165 occurs on steep, dissected sideslopes of greater than 35 percent. This landtype ranges in elevation from 3600 to 5400 feet and supports ponderosa pine stands.

Mapping Unit 165 consists dominantly of landtype 165 and minor amounts of landtype 164 which occurs on steep, nondissected to slightly dissected sideslopes and landtype 163 which supports an associated species stand.

Soil 165 is a shallow to moderately deep, nonplastic to slightly plastic soil derived from residuum and colluvium. Surface soils are thin, nongravelly to gravelly, loams or silt loams. Subsoils are generally thin, gravelly, loams or silt loams. This soil is well drained. Permeability is rapid.

Bedrock is composed of competent, hard to moderately hard, very highly fractured, fine grained sedimentary or metasedimentary rock. Depth to bedrock ranges from 10 to 24 inches.

Range of Profile Characteristics of Soil 165

Litter:	Needles, leaves, twigs and decomposing organic matter. 0 to 1 inch thick.
Surface Layers:	Brown to dark reddish brown, nongravelly to gravelly, loam to silt loam; single grained or weak to moderate, fine, subangular blocky structure; 10 to 45 percent subangular or angular gravel and cobbles by volume; nonsticky to slightly sticky, nonplastic to slightly plastic; pH ranges from 6.0 to 7.0; 6 to 20 inches thick.
Subsoil Layers:	Grayish brown to very dark brown, gravelly to very gravelly, sandy loam to silt loam; single grained or weak, fine, subangular blocky structure; 35 to 75 percent subangular or angular gravel and cobbles by volume; nonsticky to slightly sticky, nonplastic to slightly plastic; pH ranges from 5.5 to 6.5; 2 to 18 inches thick.

MAPPING UNIT 166

Landtype 166 occurs on gentle ridgetops and benches of less than 35 percent slope. This landtype ranges in elevation from 3600 to 5400 feet and supports lodgepole pine stands. Locally, this landtype supports an upper forest association at higher elevations.

Mapping Unit 166 consists dominantly of landtype 166 and minor amounts of landtype 167 which supports an associated species stand and landtype 161 which occurs on steep slopes.

Soil 166 is a shallow to moderately deep, nonplastic to slightly plastic soil derived from aeolian deposits and/or residuum. Surface soils are generally thin, silt loam ash deposits. Buried soils are generally thin to moderately thick, gravelly to very gravelly, sandy loams, loams or clay loams. This soil is well drained. Permeability is rapid in the surface soils and rapid to moderately rapid in the buried soils.

Bedrock is composed of competent to moderately competent, hard to moderately hard, very highly fractured, fine grained sedimentary or metasedimentary rock. Depth to bedrock ranges from 12 to 36 inches.

Range of Profile Characteristics of Soil 166

Litter:	Needles, leaves, twigs and decomposing organic matter. ½ to 1½ inches thick.
Surface Layers: 1/	Yellowish brown to dark brown, silt loam; single grained or weak, fine, subangular blocky structure; 0 to 10 percent angular gravel by volume; nonsticky, nonplastic; pH ranges from 5.5 to 6.5; 4 to 12 inches thick.
Buried Layers:	Grayish brown to very dark brown, gravelly to very gravelly, sandy loam to clay loam; single grained, massive or weak, fine, subangular blocky structure; 35 to 75 percent subangular or angular gravel and cobbles by volume; nonsticky to slightly sticky, nonplastic to slightly plastic; pH ranges from 5.5 to 6.5; 8 to 32 inches thick.

1/ Locally, ash deposits may be absent. Surface soils are most commonly loams or silt loams under these conditions.

MAPPING UNIT 167

Landtype 167 occurs on gentle ridgetops and benches of less than 35 percent slope. This landtype ranges in elevation from 3600 to 5600 feet and supports an associated species stand 1/.

Mapping Unit 167 consists dominantly of landtype 167 and minor amounts of landtype 168 which supports ponderosa pine and landtype 162 which occurs on steep slopes.

Soil 167 is a shallow to moderately deep, nonplastic to slightly plastic (locally plastic) soil derived from aeolian deposits and/or residuum. Surface soils are generally silt loam ash deposits. Locally ash is absent and surface soils are loams or silty clay loams. Buried soils are generally thin to moderately thick, gravelly to very gravelly, loams, silty clay loams or sandy clay loams. This soil is well to moderately well drained. Permeability is rapid in the surface soils and rapid to moderately rapid in the buried soils.

Bedrock is composed of competent to moderately competent, hard to moderately hard, fine grained sedimentary or metasedimentary rock. Depth to bedrock ranges from 10 to 40 inches.

Range of Profile Characteristics of Soil 167

Litter:	Needles, leaves, twigs and decomposing organic matter. ½ to 1½ inches thick.
Surface Layers: 2/	Yellowish brown to dark brown, silt loam; single grained or weak, fine, subangular blocky structure; 0 to 15 percent subangular or angular gravel by volume; nonsticky, nonplastic; pH ranges from 5.5 to 7.0; 4 to 16 inches thick.
Buried Layers:	Dark reddish brown to yellowish brown, nongravelly to very gravelly loam to silty clay loam; massive or weak to moderate, fine, subangular blocky structure; 10 to 65 percent subangular or angular gravel and cobbles by volume; nonsticky to sticky, nonplastic to plastic; pH ranges from 5.0 to 7.0; 6 to 36 inches thick.

2/ Locally, ash deposits are absent. The surface soils are nongravelly to gravelly, loams to silty clay loams under these conditions.

MAPPING UNIT 168

Landtype 168 occurs on gentle ridgetops and benches of less than 35 percent slope. This landtype ranges in elevation from 3600 to 5400 feet and supports site class IV and V ponderosa pine stands.

Mapping Unit 168 consists dominantly of landtype 168 and minor amounts of landtype 167 which supports an associated species stand, landtype 169 which supports site class III ponderosa pine and landtype 164 which occurs on steep slopes.

Soil 168 is a thin to moderately thick, nonplastic to slightly plastic soil derived from residuum. Surface soils are thin loams or silt loams. Subsoils are thin to moderately thick, nongravelly to gravelly, silt loams or loams. This soil is well drained. Permeability is rapid.

Bedrock is composed of competent to moderately competent, hard to moderately hard, fine grained sedimentary or metasedimentary rock. Depth to bedrock ranges from 10 to 40 inches.

Range of Profile Characteristics of Soil 168

Litter:	Needles, leaves, twigs and decomposing organic matter. 0 to 1 inch thick.
Surface Layers:	Brown to dark brown, loam to silt loam; single grained or weak, fine, subangular blocky structure; 5 to 35 percent subangular gravel by volume; nonsticky to slightly sticky, nonplastic to slightly plastic; pH ranges from 5.5 to 6.5; 6 to 12 inches thick.
Subsoil Layers:	Brown to dark brown, nongravelly to gravelly loam to silt loam; single grained or weak, fine, subangular blocky structure; 10 to 50 percent subangular or angular gravel and cobbles by volume; slightly sticky, slightly plastic; pH ranges from 5.0 to 7.0; 12 to 34 inches thick.

MAPPING UNIT 169

Landtype 169 occurs on gentle ridgetops and benches of less than 35 percent slope. This landtype ranges in elevation from 4400 to 4900 feet and supports site class III ponderosa pine stands.

Mapping Unit 169 consists dominantly of landtype 169 and minor amounts of landtype 168 which supports site class IV and V ponderosa pine.

Soil 169 is a thin to moderately thick, nonplastic to slightly plastic soil derived from residuum. Surface soils are thin loams or silt loams. Subsoils are thin to moderately thick, nongravelly to gravelly, silt loams or loams. This soil is well drained. Permeability is rapid.

Bedrock is composed of competent to moderately competent, hard to moderately hard, fine grained sedimentary or metasedimentary rock. Depth to bedrock ranges from 10 to 40 inches.

Range of Profile Characteristics of Soil 169

Litter:	Needles, leaves, twigs and decomposing organic matter. 0 to 1 inch thick.
Surface Layers: 1/	Brown to dark brown, nongravelly, loam to silt loam; single grained or weak, fine, subangular blocky structure; 5 to 35 percent subangular gravel by volume; nonsticky to slightly sticky, nonplastic to slightly plastic; pH ranges from 5.5 to 6.5; 6 to 12 inches thick.
Subsoil Layers:	Brown to dark brown, nongravelly to gravelly, loam to silt loam; single grained or weak, fine, subangular blocky structure; 10 to 50 percent subangular gravel and cobbles by volume; slightly sticky, slightly plastic; pH ranges from 5.0 to 7.0; 12 to 34 inches thick.

1/ Locally, silt loam ash deposits may be present.

MAPPING UNIT 180

Mapping Unit 180 consists of schist rock outcrop with inclusions of soil. The most common inclusions are Landtypes 5, 181, 182, 183 and 184.

Bedrock is moderately hard to hard and moderately competent to competent.

This mapping unit occurs on ridgecrests and steep sideslopes.

MAPPING UNIT 181

Landtype 181 occurs on steep, nondissected to slightly dissected sideslopes of greater than 35 percent. This landtype ranges in elevation from 5300 to 6700 feet and supports an associated species stand 1/.

Mapping Unit 181 consists dominantly of landtype 181 and minor amounts of landtype 182 which occurs on steep, dissected slopes, landtype 185 which occurs on gentle slopes and landtype 189 which supports lodgepole pine stands.

Soil 181 is a shallow to moderately deep, nonplastic to slightly plastic soil derived from aeolian deposits and/or colluvium and residuum. Surface soils are generally thin, loams. Locally, silt loam ash deposits are present. Subsoils are generally thin to moderately thick, gravelly to very gravelly, silt loams or silty clay loams. This soil is well drained. Permeability is rapid.

Bedrock is composed of moderately competent to incompetent, moderately hard to soft, schist rock. Depth to bedrock ranges from 12 to 36 inches.

Range of Profile Characteristics of Soil 181

Litter:	Needles, leaves, twigs and decomposing organic matter. ½ to 1½ inches thick.
Surface Layers: 2/	Brown to very dark grayish brown, nongravelly to gravelly, sandy loam to silt loam; weak, fine, subangular blocky structure; 10 to 45 percent subangular or angular gravel by volume; nonsticky to slightly sticky, nonplastic; pH ranges from 5.5 to 6.5; 6 to 16 inches thick.
Subsoil Layers:	Brown to dark brown, gravelly to very gravelly loam to silty clay loam; single grained or massive; 35 to 85 percent subangular or angular gravel, cobbles and stones by volume; nonsticky to sticky, nonplastic to slightly plastic; pH ranges from 5.5 to 6.5; 6 to 30 inches thick.

1/ A predominance of white fir, Douglas-fir and western larch with ponderosa pine and lodgepole pine sometimes common. Locally, in the upper North Fork of the John Day River at above 5800 feet elevation an upper forest association is present.

2/ Locally, surface soils are silt loam ash deposits.

MAPPING UNIT 182

Landtype 182 occurs on steep, dissected sideslopes of greater than 35 percent. This landtype ranges in elevation from 5300 to 6700 feet and supports an associated species stand 1/.

Mapping Unit 182 consists dominantly of landtype 182 and minor amounts of landtype 181 which occurs on steep, nondissected to slightly dissected slopes and landtype 184 which supports ponderosa pine stands.

Soil 182 is a shallow to moderately deep, nonplastic to slightly plastic soil derived from aeolian deposits and/or colluvium and residuum. Surface soils are generally thin, nongravelly loams. Locally, silt loam ash deposits are present. Subsoils are generally thin to moderately thick, gravelly to very gravelly, silt loams or silty clay loams. This soil is well drained. Permeability is rapid.

Bedrock is composed of moderately competent to incompetent, moderately hard to soft, schist rock. Depth to bedrock ranges from 12 to 36 inches.

Range of Profile Characteristics of Soil 182

Litter:	Needles, leaves, twigs and decomposing organic matter. ½ to 1½ inches thick.
Surface Layers: 2/	Brown to very dark grayish brown, nongravelly to gravelly sandy loam to silt loam; weak, fine, subangular blocky structure; 10 to 45 percent subangular or angular gravel by volume; nonsticky to slightly sticky, nonplastic; pH ranges from 5.5 to 6.5; 6 to 16 inches thick.
Subsoil Layers:	Brown to dark brown, gravelly to very gravelly, loam to silty clay loam; single grained or massive; 35 to 85 percent subangular or angular gravel, cobbles and stones by volume; nonsticky to sticky, nonplastic to slightly plastic; pH ranges from 5.5 to 6.5; 6 to 30 inches thick.

1/ A predominance of white fir, Douglas-fir and western larch with ponderosa pine, lodgepole pine and Engelmann spruce sometimes common. Locally, in the upper North Fork of the John Day River at above 5800 feet elevation an upper forest association is present

2/ Locally, surface soils are silt loam ash deposits.

MAPPING UNIT 183

Landtype 183 occurs on steep, nondissected to slightly dissected sideslopes of greater than 35 percent. This landtype ranges in elevation from 4800 to 5500 feet and supports ponderosa pine stands.

Mapping Unit 183 consists dominantly of landtype 183 and minor amounts of landtype 184 which occurs on steep, dissected slopes and landtype 186 which occurs on gentle slopes.

Soil 183 is a shallow to moderately deep, nonplastic to slightly plastic soil derived from colluvium and residuum. Surface soils are thin, nongravelly to gravelly, loams or silt loams. Subsoils are generally thin to moderately thick, gravelly, silt loams or silty clay loams. This soil is well drained. Permeability is rapid in the surface soils and rapid to moderately rapid in the subsoils.

Bedrock is composed of moderately competent, moderately hard to soft, schist rock. Depth to bedrock ranges from 12 to 36 inches.

Range of Profile Characteristics of Soil 183

Litter:	Needles, leaves, twigs and decomposing organic matter. 0 to 1 inch thick.
Surface Layers:	Brown to very dark grayish brown, nongravelly to gravelly sandy loam to silt loam; weak, fine, subangular blocky structure; 10 to 45 percent subangular or angular gravel by volume; nonsticky to slightly sticky, nonplastic; pH ranges from 5.5 to 6.5; 6 to 16 inches thick.
Subsoil Layers:	Brown to dark brown, gravelly to very gravelly loam to silty clay loam; single grained or massive; 35 to 85 percent subangular or angular gravel, cobbles and stones by volume; nonsticky to sticky, nonplastic to slightly plastic; pH ranges from 5.5 to 6.5; 6 to 30 inches thick.

MAPPING UNIT 184

Landtype 184 occurs on steep, dissected sideslopes of greater than 35 percent. This landtype ranges in elevation from 4800 to 5500 feet and supports ponderosa pine stands.

Mapping Unit 184 consists dominantly of landtype 184 and minor amounts of landtype 183 which occurs on steep, nondissected to slightly dissected slopes and landtype 182 which supports an associated species stand.

Soil 184 is a shallow to moderately deep, nonplastic to slightly plastic soil derived from colluvium and residuum. Surface soils are thin, nongravelly to gravelly, loams or silt loams. Subsoils are generally thin to moderately thick, gravelly, silt loams or silty clay loams. This soil is well drained. Permeability is rapid in the surface soils and rapid to moderately rapid in the subsoils.

Bedrock is composed of moderately competent, moderately hard to soft, schist rock. Depth to bedrock ranges from 12 to 36 inches.

Range of Profile Characteristics of Soil 184

Litter:	Needles, leaves, twigs and decomposing organic matter. 0 to 1 inch thick.
Surface Layers:	Brown to very dark grayish brown, nongravelly to gravelly, sandy loam to silt loam; weak, fine, subangular blocky structure; 10 to 45 percent subangular or angular gravel by volume; nonsticky to slightly sticky, nonplastic; pH ranges from 5.5 to 6.5; 6 to 16 inches thick.
Subsoil Layers:	Brown to dark brown, gravelly to very gravelly, loam to silty clay loam; single grained or massive; 35 to 70 percent subangular or angular gravel, cobbles and stones by volume; nonsticky to sticky, nonplastic to slightly plastic; pH ranges from 5.5 to 6.5; 6 to 30 inches thick.

MAPPING UNIT 185

Landtype 185 occurs on gentle ridgetops and benches of less than 35 percent slope. This landtype ranges in elevation from 5300 to 6700 feet and supports an associated species stand 1/.

Mapping Unit 185 consists dominantly of landtype 185 and minor amounts of landtype 186 which supports ponderosa pine and landtype 181 which occurs on steep sideslopes.

Soil 185 is a shallow to moderately deep, nonplastic to slightly plastic soil derived from aeolian deposits and/or residuum. Surface soils are generally thin, nongravelly loams. Locally, silt loam ash deposits may be present. Subsoils are generally thin to moderately thick, gravelly to very gravelly, silt loams or silty clay loams. This soil is well drained. Permeability is rapid in the surface soils and rapid to moderately rapid in the subsoils.

Bedrock is composed of moderately competent to competent, moderately hard, schist rock. Depth to bedrock ranges from 12 to 36 inches.

Range of Profile Characteristics of Soil 185

Litter:	Needles, leaves, twigs and decomposing organic matter. ½ to 1½ inches thick.
Surface Layers: 2/	Brown to very dark grayish brown, nongravelly to gravelly sandy loam to silt loam; weak, fine, subangular blocky structure; 10 to 45 percent subangular or angular gravel by volume; nonsticky to slightly sticky, nonplastic; pH ranges from 5.5 to 6.5; 6 to 16 inches thick.
Subsoil Layers:	Brown to dark brown, gravelly to very gravelly loam to silty clay loam; single grained or massive; 35 to 85 percent subangular or angular gravel, cobbles and stones by volume; nonsticky to sticky, nonplastic to slightly plastic; pH ranges from 5.5 to 6.5; 6 to 30 inches thick.

1/ A predominance of white fir, Douglas-fir and western larch with ponderosa pine and lodgepole pine sometimes common.

2/ Locally, surface soils are silt loam ash deposits.

MAPPING UNIT 186

Landtype 186 occurs on gentle ridgetops and benches of less than 35 percent slope. This landtype ranges in elevation from 4800 to 5500 feet and supports ponderosa pine stands.

Mapping Unit 186 consists dominantly of landtype 186 and minor amounts of landtype 185 which supports an associated species stand and landtype 183 which occurs on steep sideslopes.

Soil 186 is a shallow to moderately deep, nonplastic to slightly plastic soil derived from residuum. Surface soils are thin, nongravelly to gravelly, loams or silt loams. Subsoils are generally thin to moderately thick, gravelly, silt loams or silty clay loams. This soil is well drained. Permeability is rapid in the surface soils and rapid to moderately rapid in the subsoils.

Bedrock is composed of moderately competent to competent, moderately hard schist rock. Depth to bedrock ranges from 12 to 36 inches.

Range of Profile Characteristics of Soil 186

Litter:	Needles, leaves, twigs and decomposing organic matter. 0 to 1 inch thick.
Surface Layers:	Brown to very dark grayish brown, nongravelly to gravelly sandy loam to silt loam; weak, fine, subangular blocky structure; 10 to 45 percent subangular or angular gravel by volume; nonsticky to slightly sticky, nonplastic; pH ranges from 5.5 to 6.5; 6 to 16 inches thick.
Subsoil Layers:	Brown to dark brown, gravelly to very gravelly, loam to silty clay loam; single grained or massive; 35 to 85 percent subangular or angular gravel, cobbles and stones by volume; nonsticky to sticky, nonplastic to slightly plastic; pH ranges from 5.5 to 6.5; 6 to 30 inches thick.

MAPPING UNIT 189

Landtype 189 occurs on steep, nondissected to slightly dissected sideslopes of greater than 35 percent. This landtype ranges in elevation from 5200 to 5600 feet and supports lodgepole pine stands.

Mapping Unit 189 consists dominantly of landtype 189 and minor amounts of landtype 181 which supports an associated species stand.

Soil 189 is a shallow to moderately deep, nonplastic to slightly plastic soil derived from aeolian deposits and buried colluvium and residuum. Surface soils are generally thin, silt loam ash deposits. Buried soils are generally thin to moderately thick, gravelly to very gravelly, silt loams or silty clay loams. This soil is well drained. Permeability is rapid.

Bedrock is composed of moderately competent, moderately hard schist rock. Depth to bedrock ranges from 12 to 40 inches.

Range of Profile Characteristics of Soil 189

Litter:	Needles, leaves, twigs and decomposing organic matter. ½ to 1½ inches thick.
Surface Layers:	Dark brown to dark yellowish brown, silt loam; single grained or weak, fine, subangular blocky structure; 0 to 10 percent angular or subangular gravels by volume; nonsticky, nonplastic; pH ranges from 5.5 to 6.5; 4 to 18 inches thick.
Buried Layers:	Brown to dark brown, gravelly to very gravelly loam to silty clay loam; single grained or massive; 35 to 85 percent subangular or angular gravel, cobbles and stones by volume; nonsticky to sticky, nonplastic to slightly plastic; pH ranges from 5.5 to 6.5; 6 to 30 inches thick.

MAPPING UNIT 190

Mapping Unit 190 consists of serpentine rock outcrop with inclusions of soil. The most common inclusions are Landtypes 5, 191, 192, 193, 194 and 199.

Bedrock is generally competent and moderately fractured.

This mapping unit occurs on ridgecrests and steep sideslopes.

MAPPING UNIT 191

Landtype 191 occurs on steep, nondissected to slightly dissected sideslopes of greater than 35 percent. This landtype ranges in elevation from 5800 to 6500 feet and supports an upper forest association 1/.

Mapping Unit 191 consists dominantly of landtype 191 and minor amounts of landtype 192 which supports an associated species stand and landtype 195 which occurs on gentle slopes.

Soil 191 is a shallow to moderately deep, nonplastic to plastic soil derived from aeolian deposits and/or colluvium and residuum. Surface soils are generally thin, silt loam ash deposits. Buried soils are generally thin to moderately thick, gravelly, loams, clay loams or silty clay loams. This soil is well drained. Permeability is rapid in the surface soils and rapid to moderately rapid in the subsoils.

Bedrock is composed of moderately competent, moderately hard, dark gray or black to olive green, serpentine rock. Depth to bedrock ranges from 8 to 36 inches.

Range of Profile Characteristics of Soil 191

Litter:	Needles, leaves, twigs and decomposing organic matter. ½ to 1½ inches thick.
Surface Layers: 2/	Yellowish brown to dark brown silt loam; single grained or weak, fine, subangular blocky structure; 0 to 10 percent subangular gravel by volume; nonsticky, nonplastic; pH ranges from 6.0 to 7.0; 4 to 18 inches thick.
Buried Layers:	Dark brown to dark yellowish brown, nongravelly to gravelly, loam to silty clay loam; massive; 10 to 40 percent subangular gravel and cobbles by volume; nonsticky to sticky, nonplastic to plastic; pH ranges from 5.0 to 7.0; 4 to 32 inches thick.

1/ A predominance of Engelmann spruce and subalpine fir with lodgepole pine, white fir and western larch sometimes common.

2/ Locally, ash deposits are less than 4 inches or absent. Surface soils are generally gravelly loams, clay loams or silty clay loams under these conditions.

MAPPING UNIT 192

Landtype 192 occurs on steep, nondissected to slightly dissected sideslopes of greater than 35 percent. This landtype ranges in elevation from 4600 to 6000 feet and supports an associated species stand 1/.

Mapping Unit 192 consists dominantly of landtype 192 and minor amounts of landtype 191 which supports an upper forest association, landtype 193 which occurs on steep, dissected slopes, landtype 194 which supports ponderosa pine and landtype 197 which occurs on gentle slopes.

Soil 192 is a shallow to moderately deep, nonplastic to plastic soil derived from aeolian deposits and/or colluvium and residuum. Surface soils are generally thin, silt loam ash deposits. Buried soils are generally thin to moderately thick, gravelly loams, clay loams or silty clay loams. This soil is well drained. Permeability is rapid in the surface soils and rapid to moderately rapid in the buried soils.

Bedrock is composed of moderately competent, moderately hard, dark gray or black to olive green, serpentine rock. Depth to bedrock ranges from 8 to 36 inches.

Range of Profile Characteristics of Soil 192

Litter:	Needles, leaves, twigs and decomposing organic matter. ½ to 1½ inches thick.
Surface Layers: 2/	Yellowish brown to dark brown silt loam; single grained or weak, fine, subangular blocky structure; 0 to 10 percent subangular gravel by volume; nonsticky, nonplastic; pH ranges from 6.0 to 7.0; 4 to 18 inches thick.
Buried Layers:	Dark brown to dark yellowish brown, nongravelly to gravelly, loam to silty clay loam; massive; 10 to 40 percent subangular gravel and cobbles by volume; nonsticky to sticky, nonplastic to plastic; pH ranges from 5.0 to 7.0; 4 to 32 inches thick.

1/ A predominance of white fir, Douglas-fir and western larch with ponderosa pine and lodgepole pine sometimes common.

2/ Locally, ash deposits are less than 4 inches thick or absent. Surface soils are generally gravelly loams, clay loams or silty clay loams under these conditions.

MAPPING UNIT 193

Landtype 193 occurs on steep, dissected sideslopes of greater than 35 percent. This landtype ranges in elevation from 4600 to 6000 feet and supports an associated species stand 1/.

Mapping Unit 193 consists dominantly of landtype 193 and minor amounts of landtype 192 which occurs on steep, nondissected to slightly dissected slopes.

Soil 193 is a shallow to moderately deep, nonplastic to plastic soil derived from aeolian deposits and/or colluvium and residuum. Surface soils are generally thin, silt loam ash deposits. Buried soils are generally thin to moderately thick, gravelly loams, clay loams or silty clay loams. This soil is well drained. Permeability is rapid in the surface soils and rapid to moderately rapid in the buried soils.

Bedrock is composed of moderately competent, moderately hard, dark gray or black to olive green, serpentine rock. Depth to bedrock ranges from 8 to 36 inches.

Range of Profile Characteristics of Soil 193

Litter:	Needles, leaves, twigs and decomposing organic matter. ½ to 1½ inches thick.
Surface Layers: 2/	Yellowish brown to dark brown silt loam; single grained or weak, fine, subangular blocky structure; 0 to 10 percent subangular gravel by volume; nonsticky, nonplastic; pH ranges from 6.0 to 7.0; 4 to 18 inches thick.
Buried Layers:	Dark brown to dark yellowish brown, nongravelly to gravelly, loam to silty clay loam; massive; 10 to 40 percent subangular gravel and cobbles by volume; nonsticky to sticky, nonplastic to plastic; pH ranges from 5.0 to 7.0; 4 to 32 inches thick.

1/ A predominance of white fir, Douglas-fir and western larch with ponderosa pine and lodgepole pine sometimes common.

2/ Locally, ash deposits are less than 4 inches thick or absent. Surface soils are generally gravelly loams, clay loams or silty clay loams under these conditions.

MAPPING UNIT 194

Landtype 194 occurs on steep, nondissected to slightly dissected sideslopes of greater than 35 percent with southerly aspects. This landtype ranges in elevation from 4500 to 5500 feet and supports ponderosa pine stands.

Mapping Unit 194 consists dominantly of landtype 194 and minor amounts of landtype 192 which supports an associated species stand and landtype 198 which occurs on gentle slopes.

Soil 194 is a shallow to moderately deep, nonplastic to plastic soil derived from colluvium and residuum. Surface soils are generally thin, nongravelly to gravelly, loams, clay or silty clay loams. Subsoils are generally thin to moderately thick, gravelly, loams, clay loams or silty clay loams. This soil is well drained. Permeability is rapid in the surface soils and rapid to moderately rapid in the subsoils.

Bedrock is composed of moderately competent, moderately hard, dark gray or black to olive green, serpentine rock. Depth to bedrock ranges from 8 to 36 inches.

Range of Profile Characteristics of Soil 194

Litter:	Needles, leaves, twigs and decomposing organic matter. 0 to 1 inch thick.
Surface Layers:	Brown to dark yellowish brown, nongravelly to gravelly, loam to silty clay loam; weak to moderate, fine, subangular blocky structure; 0 to 40 percent subangular gravel and cobbles by volume; nonsticky to sticky, nonplastic to plastic; pH ranges from 5.5 to 7.0; 6 to 16 inches thick.
Subsoil Layers:	Dark brown to dark yellowish brown, nongravelly to gravelly, loam to silty clay loam; massive; 10 to 50 percent subangular gravel, cobbles and stones by volume; nonsticky to sticky, nonplastic to plastic; pH ranges from 5.0 to 7.0; 4 to 32 inches thick.

MAPPING UNIT 195

Landtype 195 occurs on gentle ridgetops and benches of less than 35 percent slope. This landtype ranges in elevation from 5800 to 6800 feet and supports an upper forest association 1/.

Mapping Unit 195 consists dominantly of landtype 195 and minor amounts of landtype 196 which supports lodgepole pine, landtype 197 which supports an associated species stand and landtype 191 which occurs on steep slopes.

Soil 195 is a shallow to moderately deep, nonplastic to plastic soil derived from aeolian and buried residuum. Surface soils are generally thin, silt loam ash deposits. Buried soils are generally thin to moderately thick, gravelly, loams, clay loams or silty clay loams. This soil is well drained. Permeability is rapid in the surface soils and rapid to moderately rapid in the buried soils.

Bedrock is composed of moderately competent, moderately hard, dark gray or black to olive green, serpentine rock. Depth to bedrock ranges from 8 to 36 inches.

Range of Profile Characteristics of Soil 195

Litter:	Needles, leaves, twigs and decomposing organic matter. ½ to 1½ inches thick.
Surface Layers:	Yellowish brown to dark brown silt loam; single grained or weak, fine, subangular blocky structure; 0 to 10 percent subangular gravel by volume; nonsticky, nonplastic; pH ranges from 6.0 to 7.0; 4 to 18 inches thick.
Buried Layers:	Dark brown to dark yellowish brown, nongravelly to gravelly, loam to silty clay loam; massive; 10 to 40 percent subangular gravel and cobbles by volume; nonsticky to sticky, nonplastic to plastic; pH ranges from 5.0 to 7.0; 4 to 32 inches thick.

1/ A predominance of subalpine fir, Engelmann spruce and lodgepole pine with white fir and western larch sometimes common.

MAPPING UNIT 196

Landtype 196 occurs on gentle ridgetops and benches of less than 35 percent slope. This landtype ranges in elevation from 4600 to 6200 feet and supports lodgepole pine stands.

Mapping Unit 196 consists dominantly of landtype 196 and minor amounts of landtype 195 which supports an upper forest association and landtype 197 which supports an associated species stand.

Soil 196 is a shallow to moderately deep, nonplastic to plastic soil derived from aeolian deposits and buried residuum. Surface soils are generally thin, silt loam ash deposits. Buried soils are generally thin to moderately thick, gravelly, loams, clay loams or silty clay loams. This soil is well drained. Permeability is rapid in the surface soils and rapid to moderately rapid in the buried soils.

Bedrock is composed of moderately competent, moderately hard, dark gray or black to olive green, serpentine rock. Depth to bedrock ranges from 8 to 36 inches.

Range of Profile Characteristics of Soil 196

Litter:	Needles, leaves, twigs and decomposing organic matter. ½ to 1½ inches thick.
Surface Layers:	Yellowish brown to dark brown silt loam; single grained or weak, fine, subangular blocky structure; 0 to 10 percent subangular gravel by volume; nonsticky, nonplastic; pH ranges from 6.0 to 7.0; 4 to 18 inches thick.
Buried Layers:	Dark brown to dark yellowish brown, nongravelly to gravelly, loam to silty clay loam; massive; 10 to 40 percent subangular gravel and cobbles by volume; nonsticky to sticky, nonplastic to plastic; pH ranges from 5.0 to 7.0; 4 to 32 inches thick.

MAPPING UNIT 197

Landtype 197 occurs on gentle ridgetops and benches of less than 35 percent slope. This landtype ranges in elevation from 4600 to 6000 feet and supports an associated species stand 1/.

Mapping Unit 197 consists dominantly of landtype 197 and minor amounts of landtype 199 which may occur on concave positions of slopes which are over 20 percent and landtype 192 which occurs on steep slopes.

Soil 197 is a shallow to moderately deep, nonplastic to slightly plastic soil derived from aeolian and/or residuum. Surface soils are generally very thin to thin, silt loam ash deposits. Locally, ash deposits are absent. Buried soils are thin, nongravelly to gravelly loams, silt loams or silty clay loams. This soil is well drained. Permeability is rapid in the surface soils and moderately rapid to slow in the buried soils.

Bedrock is composed of moderately competent, moderately hard to hard, dark gray or black to olive green, serpentine rock. Depth to bedrock ranges from 10 to 40 inches.

Range of Profile Characteristics of Soil 197

Litter:	Needles, leaves, twigs and decomposing organic matter. ¼ to 1 inch thick.
Surface Layers: 2/	Dark yellowish brown to yellowish brown, silt loam; single grained or weak, fine, subangular blocky structure; 0 to 10 percent subangular gravel by volume; nonsticky, nonplastic; pH ranges from 6.0 to 7.0; 0 to 18 inches thick.
Buried Layers: 3/	Dark brown to dark yellowish brown, nongravelly to gravelly, loam to silty clay loam; massive; 10 to 40 percent subangular gravel, cobbles and stones by volume; nonsticky to sticky, nonplastic to plastic; pH ranges from 5.0 to 7.0; 1 to 36 inches thick.

1/ A predominance of white fir, western larch and Douglas-fir with ponderosa pine and lodgepole pine sometines common.

2/ Locally, the ash surface layer may be absent. Surface soils are generally nongravelly or gravelly, loams or silt loams under these conditions.

3/ Locally, ash is to bedrock and there is no buried layer.

MAPPING UNIT 198

Landtype 198 occurs on gentle ridgetops and benches of less than 35 percent slope. This landtype ranges in elevation from 4500 to 5500 feet and supports ponderosa pine stands.

Mapping Unit 198 consists dominantly of landtype 198 and minor amounts of landtype 197 which supports an associated species stand and landtype 194 which occurs on steep slopes.

Soil 198 is a shallow to moderately deep, nonplastic to slightly plastic soil derived from aeolian deposits and/or residuum. Surface soils are generally very thin to thin, loams, silt loams or clay loams. Locally ash deposits are present. Subsoils are generally thin, nongravelly to gravelly, loams, silt loams or silty clay loams. This soil is well drained. Permeability is rapid in the surface soils and rapid to moderately rapid in the subsoils.

Bedrock is composed of moderately competent, moderately hard to hard, dark gray or black to olive green, serpentine rock. Depth to bedrock ranges from 10 to 30 inches.

Range of Profile Characteristics of Soil 198

Litter:	Needles, leaves, twigs and decomposing organic matter. 0 to 1 inch thick.
Surface Layers: 1/	Dark yellowish brown to yellowish brown, nongravelly to gravelly, loam to clay loam; single grained, massive or weak, fine, subangular blocky structure; 0 to 40 percent subangular gravel by volume; nonsticky, nonplastic; pH ranges from 6.0 to 7.0; 4 to 18 inches thick.
Subsoil Layers:	Dark brown to dark yellowish brown, nongravelly to gravelly, loam to silty clay loam; massive; 10 to 40 percent subangular gravel, cobbles and stones by volume; nonsticky to sticky, nonplastic to plastic; pH ranges from 5.0 to 7.0; 1 to 30 inches thick.

1/ Locally, surface soils are silt loam ash deposits.

MAPPING UNIT 199

Landtype 199 occurs on moderate slopes which have concave and uneven, dissected sideslopes. Slopes are generally greater than 20 percent. This landtype ranges in elevation from 5200 to 6100 feet and supports an associated species stand 1/.

Mapping Unit 199 consists dominantly of landtype 199 and minor amounts of landtype 193 which is dissected but has a more competent bedrock and soil stability situation and landtype 197 which occurs on gentle slopes with more stable bedrock and soil characteristics.

Soil 199 is a deep to extremely deep, slightly plastic to plastic soil derived from aeolian and buried residuum and colluvium. Surface soils are generally very thin to thin silt loam ash deposits. Buried soils are generally thick to very thick, gravelly, silty clay loams or clay loams. This soil is moderately well to imperfectly drained. Permeability is rapid in the surface soils and moderate to slow in the buried soils.

Bedrock is composed of incompetent and moderately competent, soft (sometimes saprolitic), gray to dark green, serpentine rock. Depth to bedrock is greater than 60 inches.

Range of Profile Characteristics of Soil 199

Litter:	Needles, leaves, twigs and decomposing organic matter. ½ to 2 inches thick.
Surface Layers:	Light to dark brown, silt loam; single grained or weak, fine, subangular blocky structure; 0 to 10 percent subangular gravel by volume; nonsticky, nonplastic; pH ranges from 6.0 to 7.0; 6 to 30 inches thick.
Buried Layers:	Dark brown to brown, nongravelly to gravelly, clay loam to clay; massive; 15 to 50 percent subangular gravel and cobbles by volume; sticky to very sticky, slightly plastic to plastic; pH ranges from 6.5 to 7.5; greater than 50 inches thick.

1/ A predominance of white fir, Douglas-fir and western larch with Engelmann spruce, lodgepole pine and ponderosa pine sometimes common.

APPENDIX I

SOILS OF THE AREA

Within the Wallowa-Whitman National Forest SRI survey area numerous soils were recognized. Many soils have only minor differences while between others the differences are major. Soil differences result from variations in one or more of the soil forming processes. The processes include climate, topography, parent material, vegetation, and time. These processes are interrelated and thus one can expect soil differences with a change in any one of the soil forming processes. Soil differences produce a variety of situations. With additional knowledge of the soils of the area as portrayed in this report and the follow up which will come from small area studies, impacts upon the land resulting from man's activities can be kept at a low level.

The following is a brief discussion of a few of the major soils or groups of soils within the Wallowa-Whitman National Forest:

Volcanic Ash - Virtually the entire Forest has been blanketed by ash primarily from Mt. Mazama and Glacier Peak. Time has allowed much of it to be eroded away by wind and water. Today roughly 60 percent of the Wallowa-Whitman National Forest is still significantly influenced by a deposit of ash.

Volcanic ash has been observed in profile to range from soil surface to bedrock or from soil surface to the surface of an older buried soil. The average thickness for ash under an associated species stand on gentle slopes is between 12 and 18 inches. Slope, aspect and vegetative cover have a significant influence on ash thickness.

Volcanic ash soil has several unique characteristics which separate it from other soils when considering activities for areas involving ash. These characteristics include high water infiltration rates, high water holding capacity, low compactibility, high detachability, and an unusually low bulk density as related to other soils. Management should be conscious of the interrelationship of the foregoing characteristics. Under undisturbed conditions of the ash soil supports good vegetative cover which protects the ash from erosion forces of wind and water. Volcanic ash is highly susceptible to erosion when vegetative cover and accompanying litter is removed. The greatest factors determining the possibility for erosion are lack of soil structure and ease of detachability. Both the high possibility of erosion by water, but there is the always present wind and the possibility for water to concentrate which will lead to erosion when these soils are severely disturbed. Since the greatest concentration of nutrients for plant growth is found in the top three inches of the ash soils, even slight erosion can result in significant reduction in productivity. (See Appendix VIII)

Shallow Grassland Soils - A fair percentage of the Wallowa-Whitman National Forest supports forbs and/or shrubs. Shallow soils or very shallow soils are the primary reason for these non-forested areas. Shallow soils have a limited water holding capacity and this generally is the limiting factor for plant growth. As soil depth increases, plant growth also increases in size and quantity. Moisture available for plant growth is further influenced by aspect. The combination of soil depth and aspect are critical to grassland types.

Soils in this group generally have weak to medium structure, and are well drained. Textures range from loam to silty clay and the depth to bedrock is generally less than two feet. All rock types are found underlying these landtypes; however, basalt is the most common.

Forested Shallow Soils - This group of soils is found throughout the Forest and generally supports conifer plant community types of vegetation. The soils are generally weakly structured, well drained, and textures range from sandy loam to clay loam. The underlying rock includes all types found on the Forest. The resultant vegetation on these shallow soils is highly dependant on elevation and aspect. At higher elevations the overstory makeup is of an Upper Forest Association, including Engelmann spruce, subalpine fir, western larch, and white fir, along with some lodgepole pine, usually found in closed stands. At lower elevations the overstory makeup is of an associated species stand, Douglas-fir/ponderosa pine stand or ponderosa pine stand. Aspect has its greatest influence at the lower elevations. In many cases the facing slopes which are protected from direct sunlight tend to support associated species stands while southfacing aspects tend more toward Douglas-fir/ponderosa pine stands, or simply ponderosa pine stands.

Forested Deep Soils - These include alluvium, which is generally extremely coarse textured water laid soil; colluvium, which is gravitational soil; glacial drift, which is glacial derived soil, and residuum which is soil that has been developed through years of bedrock weathering.

Vegetation is generally an associated species overstory with an Upper Forest Association found at higher elevations and ponderosa pine stands found at lower elevations.

APPENDIX II

1/GENERALIZED GEOLOGY OF THE AREA

The bedrock found on the Wallowa-Whitman National Forest is quite variable. Bedrock types include all three of the major modes of origin -- sedimentary, igneous and metamorphic. The oldest rocks of the area are metamorphic and date back to the Permian Period of the Paleozoic Era. These rocks include the Elkhorn Ridge Argillite, Clover Creek Greenstone and the Burnt River Schist (Gilluly 1937). Since this time of early development, the area has witnessed and undergone a variety of changes including faulting, uplifts, volcanic activity, glaciation and erosion. All five surface-shaping forces have occurred at different intervals throughout geologic time and have contributed to the present landform.

For the purpose of the SRI, numerous rock types have been separated into seven groups. Each group may include a variety of rocks, but only the most common and extensive are mentioned. These groups separate out through some of the engineering or hydrologic interpretations. The groups include: pyroclastic rocks (landtypes 50-99); basalt, andesite and metavolcanic rocks (landtypes 100-120); granodiorite rocks (landtypes 130-147); metagabbro, granitic gneiss, and coarse-grained metasedimentary rocks (landtypes 150-158); argillite and other fine-grained metasedimentary rocks (landtypes 160-169); schist (landtypes 180-189); and serpentine (landtypes 190-199). See Generalized Bedrock Maps, pages 157 and 158.

Group Discussion -

Pyroclastic Rocks - This is a broad group of rocks whose primary fragments originated as explosive volcanic ejecta. After deposition this material was subjected to one of several processes. Much that fell on bodies of water settled to the bottom and later became consolidated. Other volcanic ejecta may have become involved in mud flow activity that incorporated the ejecta with preexisting soil and rocks which later solidified and hardened to form pyroclastic rocks. Pyroclastic rocks are found as continuous areas or as interflows between basalt and andesite flows. A few of the general names used for pyroclastic rocks include, tuffs, breccias, rhyolitic tuffs, and volcanic sediments. There are also small deposits of pyroclastic glass in the Dooley Mountain area.

In general pyroclastic rocks have little resistance to weathering and are often associated with unstable soils. As a group they are moderately hard to soft and moderately competent to incompetent; locally, the rock is hard and competent. These rocks are generally highly fractured and usually lack definite fracture patterns. Colors are variable and may be whitish gray, tan, red, yellow, blue-gray or black. Often incorporated with pyroclastic rocks are basaltic fragments. Soils derived from these rocks are

described in landtypes 50 through 99. Many of the pyroclastics have been weathered so extensively that they are no longer recognizable as rock. Landtypes with these characteristics include 69, 76, 77, 89, 94 and 95.

Andesite and Basalt Rock - These rocks are generally fine-grained, hard and competent, and usually highly fractured to either blocky or platy fracture systems. Colors range from gray to black. These rocks are among the most resistant in the area. Pyroclastic rocks to a small degree are associated with basalt rocks as interflows. Soils derived from these rocks are described in landtypes 100 through 120. The largest continuous areas include the north half of the La Grande Ranger District and most of the area north and east of Enterprise.

Granodiorite Rock - The granodioritic rocks (often called granitic rocks) make up two large areas on the Forest. One, for the most part, occurs within the Eagle Cap Wilderness area, while the second takes in a large area north and south of Anthony Lakes. The rock can be hard and blocky or, as in many cases, it can be weathered to depths of greater than 20 feet. Soils derived from these rocks are described in landtypes 130 through 147.

Metagabbro, Granitic Gneiss and Coarse-grained Metasedimentary Rocks - These rocks are generally hard, moderately to highly fractured, and competent. Generally these rocks are all coarse-grained and the soil derived from them is moderately coarse to medium textured. There are no large areas of this rock type. It is generally found in areas which include metavolcanic rocks, serpentine and schist. Soils derived from these rocks are described in landtypes 150 through 158.

Argillite and Other Fine-grained Metasedimentary Rocks - These rocks are generally moderately hard to hard, highly fractured, and competent to moderately competent. Most of the rock is fractured into a platy or highly fractured blocky structure. This rock is found in three areas; one is the Elkhorn Argillite which occurs as a wide band running east and west from Sumpter; the second is found in the Eagle Creek area north of Sparta; and the third occurs south of Unity. Soils derived from these rocks are described in landtypes 160 through 169.

Schist - The schist rock is generally soft to moderately hard, highly fractured, and moderately competent. This rock is found in two areas: one, the Burnt River Schist, is south of Baker in the Dooley Mountain area, and the second is a rather small area in the upper North Fork of the John Day River. Soils derived from this rock are described in landtypes 180 through 189.

Serpentine - Serpentine rock is generally soft to moderately hard, highly fractured, and moderately competent. Serpentine as a rock is highly metamorphosed and is generally dark gray to olive

in color. This rock and its residual soil is notably different from the other rock and soil combinations it continuously seeks an angle of repose which appears to be at roughly 40 to 50 percent. Soil creep is evident at slopes of greater than 50 percent. Also this rock type, when weathered to soil, tends to show some nutrient deficiencies. (See Appendix IX on fertility.) Soils derived from this rock are described in landtypes 190 through 199.

Glaciation - Glaciation has played a significant part in the shaping of Wallowa-Whitman National Forest. Two areas have experienced local glaciation. These include the Eagle Cap Wilderness area and the Elkhorn Mountain area from Baker Watershed west to Mt. Ireland and north to Anthony Lakes. Cirque basins, small lakes, very steep sideslopes, hanging valleys and broad "U-shaped" valleys are descriptive terms used to characterize glacial modifications. Even though this event is quite extensive, the soils which normally accompany glaciation are not compacted and the usual accompanying glacial drift and till makes up only a minor part of the soil for the area. Soils derived from glacial activity are described in landtypes 40 through 47.

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Figure 2
GENERALIZED BEDROCK MAP

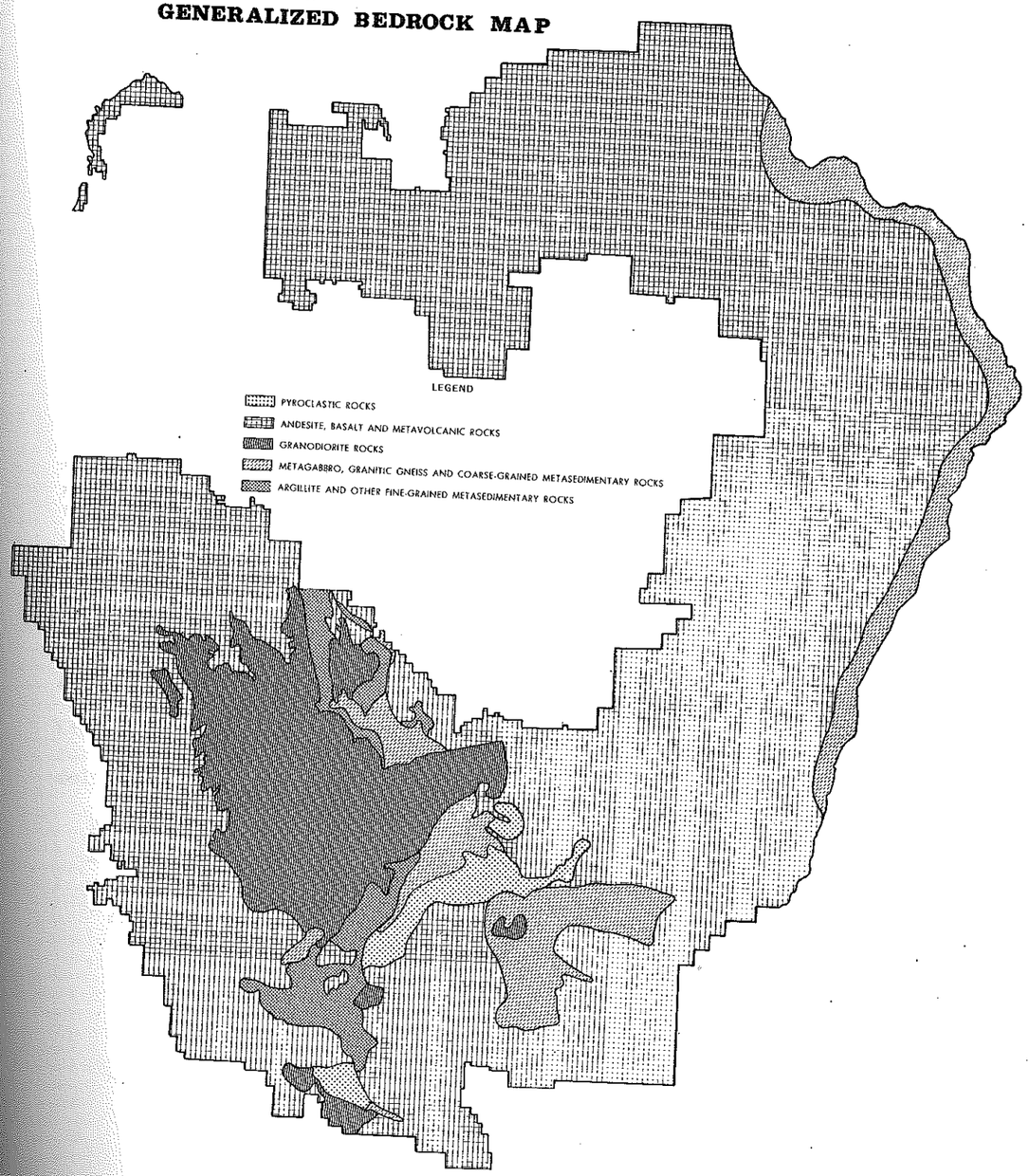
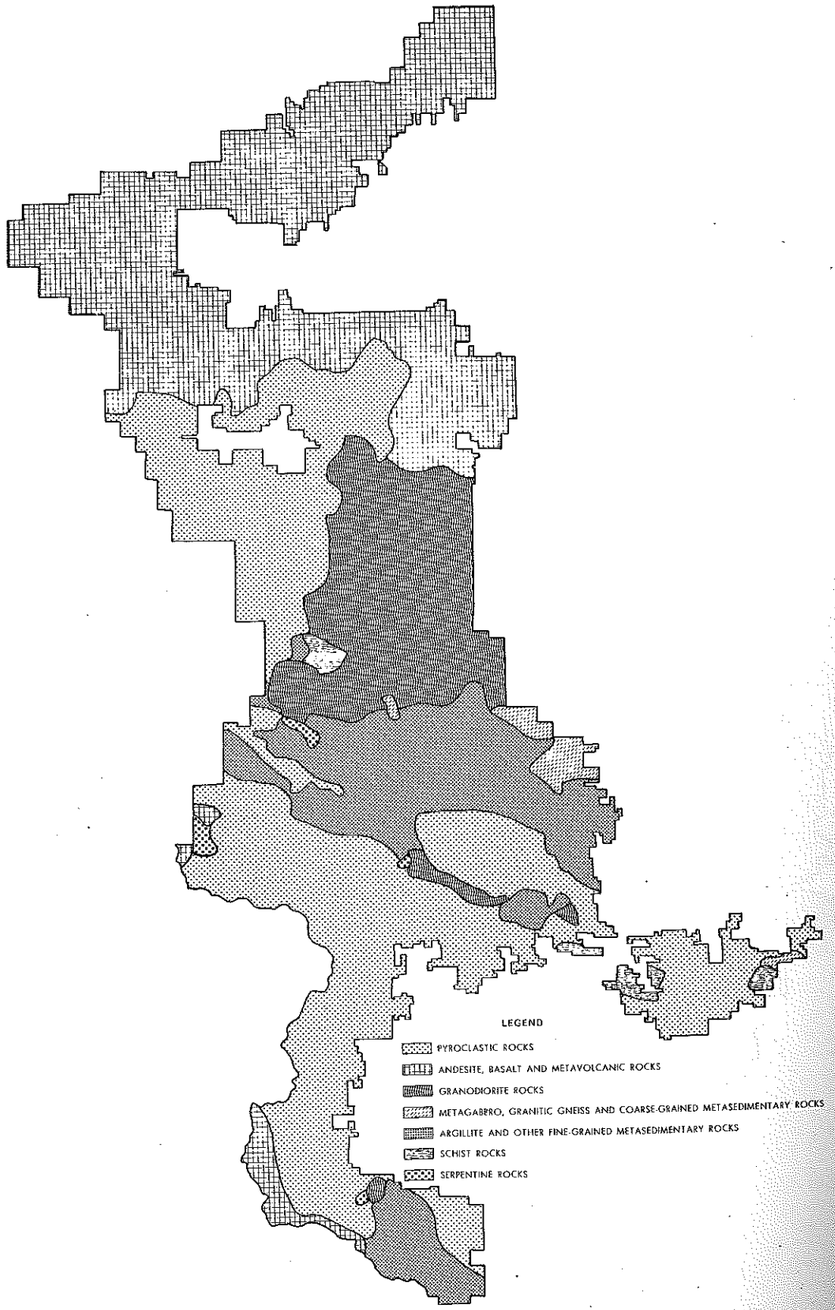


Figure 3

GENERALIZED BEDROCK MAP



APPENDIX III

VEGETATION

On the Wallowa-Whitman National Forest vegetation patterns often are distinct and contrasting. Elevation, length of growing season, aspect, temperature, soils and plant-available moisture are the major factors that influence vegetation type and distribution.

In the upper elevations, particularly in the Elkhorn and Eagle Cap Mountain Ranges, the effects of abundant moisture, heavy snowfall, cold winter temperatures, and short growing seasons are strongly expressed throughout the large areas with minimal influence from moderate elevation and aspect changes. Vegetative changes are therefore comparatively subtle over large areas. This situation normally holds true above 6,000 feet elevation.

As elevation decreases from 6,000 feet, the reduction in available moisture and increased summer temperatures, as modified by aspect and topography, become increasingly effective in the determination of vegetative patterns and types. At the lower elevations moisture becomes a limiting factor for growth. The annual precipitation is much lower than at higher elevations[1/] and the summer temperatures are much warmer with higher rates of evapotranspiration. At the middle elevations (3,500 feet to 5,500 feet) the influence of aspect becomes of major importance. Northern exposures are cooler with lower evapotranspiration rates and can often support vegetative types that are unable to survive on the hot, drouthy southern slopes. Consequently, vegetation patterns are often distinct and abrupt with variations of aspect and topography.

Six broad vegetative groups were observed and used as additional criteria for developing different landtypes. The vegetative groups are listed as follows:

Vegetative Group	General Grouping	Overstory Species
A	Scabland, grassland and shrubland	None
B	Open ponderosa pine, brush and grass	Ponderosa pine
C	Ponderosa pine/Douglas-fir	Ponderosa pine, Douglas-fir
D	Associated Species stands	White fir, Douglas-fir, western larch, ponderosa pine, and lodgepole pine

1/ See Isohyetal Maps, pp. 166 and 167

Vegetative Group	General Grouping	Overstory Species
E	Lodgepole pine stands	Lodgepole pine, western larch, ponderosa pine
F	Upper Forest Association	Subalpine fir, Engelmann spruce, lodgepole pine, white fir
G	Alpine species	Subalpine fir, white bark pine, lodgepole pine

APPENDIX IV

CLIMATE

This appendix contains a brief narrative description of the climate of the Soil Resource Inventory survey area. Also included in this appendix are tables of Average Mean Monthly Temperatures and Precipitation Data, and an Isohyetal Map of the survey area.

CLIMATE

The climate of the Wallowa-Whitman National Forest is influenced by its topography, the topography of surrounding areas and the pressure systems which approach from surrounding areas. Annual precipitation increases as elevation increases from a low of 8 inches at 3,400 feet near Haines to more than 80 inches in the high mountain areas over 9,000 feet. 1/ The heavy precipitation in the Cascade and coast ranges lessens the amount of moisture available in air masses moving in from the west causing a relatively dry climate.

Approximately 40 percent of the annual precipitation occurs in winter, with 25 percent in spring, 11 percent in summer and 24 percent in fall. The precipitation is generally in the form of snow from November 1 to April 30 although wide ranges occur due to elevation differences. Two precipitation maximums occur, one in December or January due to large storm systems approaching from the west or northwest and a second in May due to unstable air masses approaching from the south or southwest. 2/

The Forest experiences wide seasonal ranges in temperature. The mean monthly temperature for January at 14 stations including a variety of elevation averages 24.7 degrees, while the mean monthly temperature for July at the same stations averages 65.0 degrees. Recorded extreme temperatures range from well below 0 degrees to more than 100 degrees.

Summer Conditions: High temperatures and little precipitation are normal on the forest during the summer months. In an average year, June, July and August supply only 11.5 percent of the total annual precipitation. Temperatures exceeding 100 degrees are not uncommon at lower elevations during this period. The highest recorded temperature is 110 degrees at Richland in July. Summer winds are divided fairly evenly between southeast and northwest, depending upon the locations of pressure cells near the coast and in Idaho. Unstable air moving in from northern California brings spring precipitation and in conjunction with local convectional storms, causes much of the low precipitation electrical storm activity during the summer. 2/ The high temperatures, low precipitation, and associated low humidities cause high fire danger from mid June until the first significant fall rains (usually in September).

Winter Conditions: Fall and winter conditions are generally determined by air masses originating in the North Pacific Ocean and moving into the area from a west or northwesterly direction. Incoming low pressure cells are usually preceeded by heavy precipitation and result in prevailing southwest or westerly winds. 2/ The coldest winter temperatures occur when air from a cold high pressure system in central Canada moves southwestward across the Rockies and flows down into the Columbia Basin. 3/ The lowest recorded temperature in the area was - 52 degrees at Austin in January although temperatures less than - 30 degrees are uncommon. The average frost-free season ranges from 100 days in the mountains to 200 days along the Snake River. 4/

Monthly snow depth measurements made across the Forest indicate variations from a few inches in low elevation valleys to 100 inches or more in the high mountain areas. These values reflect snow accumulation rather than total snowfall which averages 39.4 inches in Baker and 169.9 inches at Granite, occasionally exceeding 200 inches. It is common for patches of snow in the high mountain areas to persist from one year to the next.

1/ Data and original isohyetal map furnished by U.S. Weather Bureau River Forecast Center, Portland, Oregon. Data used was accumulated through 1957.

2/ Oral communication with U.S. Weather Bureau, Pendleton, Oregon, 12/24/74.

3/ Local Climatological Data, Annual Summary with Comparative Data, 1966, Pendleton, Oregon. Narrative climatological summary.

4/ Powder Drainage Basin, U.S.D.A. report on water and related land resources. (page-5)

FIGURE 4

CLIMATIC DATA (1)

Mean Monthly Temperatures And Mean Monthly Precipitation

Station	Elevation	Data Years	January		February		March		April		May		June		July		August		September		October		November		December		Annual (5)
			Temp. (2)	Ppt. (3)	Temp.	Ppt.	Temp.	Ppt.	Temp.	Ppt.	Temp.	Ppt.	Temp.	Ppt.	Temp.	Ppt.	Temp.	Ppt.	Temp.	Ppt.	Temp.	Ppt.	Temp.	Ppt.	Temp.	Ppt. (4)	
Wallowa	2935'	58	24.1	1.73	29.1	1.56	37.8	1.52	45.6	1.48	52.1	1.75	58.4	1.75	65.3	0.63	63.2	0.67	56.1	1.12	46.8	1.53	35.5	2.03	27.8	1.84	45.2	17.56
Elgin	2670'	23	28.6	2.47	33.2	2.76	38.8	2.27	47.1	1.57	53.7	2.00	59.1	1.79	67.1	0.53	64.8	0.62	58.1	1.03	48.3	2.20	37.4	3.10	32.9	3.10	47.4	23.44
Meacham	4030'	16	25.5	4.15	29.8	3.72	32.9	3.14	40.5	2.54	48.3	2.72	54.0	2.12	63.7	0.49	61.9	0.65	56.0	1.54	45.7	2.89	34.7	4.12	29.8	4.79	43.6	32.87
Enterprise	3760'	29	23.5	0.89	28.1	0.84	34.9	1.10	43.5	1.20	50.3	1.75	55.9	2.19	63.0	0.62	60.5	0.60	54.4	1.02	45.7	1.13	33.8	1.02	27.4	0.99	43.4	13.35
Cove	3100'	44	28.9	2.16	33.4	1.89	39.1	2.26	46.3	2.33	53.0	2.45	59.2	2.33	67.2	0.55	65.2	0.80	57.9	1.38	48.8	2.05	38.5	2.57	32.1	2.52	47.5	23.29
La Grande	2782'	73	30.0	2.01	33.7	1.93	40.1	2.01	47.8	1.78	55.0	2.01	61.4	1.67	70.0	0.56	68.7	0.64	59.9	1.09	50.1	1.59	39.8	2.20	33.2	2.21	49.1	19.70
Union	2765'	50	29.1	1.07	33.8	1.00	39.9	1.25	47.0	1.39	53.4	1.69	59.2	1.66	66.4	0.48	64.7	0.61	57.1	0.87	48.4	1.19	39.0	1.20	32.4	1.21	47.5	13.62
Cremsite	4939'	20	20.0	3.11	24.3	2.93	28.1	2.45	37.2	1.55	45.0	1.68	51.3	1.72	58.5	0.64	56.7	0.49	51.6	0.95	42.1	1.75	30.3	2.57	23.9	3.05	39.1	22.89
Baker	3446'	70	25.2	1.07	30.2	0.97	37.2	1.04	45.1	0.92	52.1	1.36	58.7	1.31	66.1	0.18	64.8	0.43	56.4	0.66	48.7	0.77	38.4	0.99	29.7	1.12	45.9	11.12
Halfway	2683'	19	22.3	3.05	28.7	2.65	36.9	1.68	46.8	1.61	54.1	1.90	59.7	1.45	67.8	0.34	65.8	0.33	58.7	0.78	47.7	1.28	35.8	2.35	27.9	3.23	46.0	20.65
Richland	2215'	44	27.8	1.20	34.5	1.04	41.5	0.77	49.1	0.83	56.8	1.33	64.2	0.85	72.3	0.25	70.6	0.33	60.8	0.58	50.0	0.74	39.4	1.16	30.6	1.36	49.8	10.44
Austin	4213'	40	28.4	2.76	25.5	2.21	32.7	1.88	41.5	1.26	48.1	1.46	54.6	1.48	61.8	0.57	59.4	0.55	52.4	0.80	43.3	1.49	31.7	2.15	24.6	2.73	41.3	19.24
Unity	4437'	24	22.0	1.06	27.5	0.95	34.2	0.78	42.6	0.62	49.6	1.38	56.1	1.24	64.4	0.55	62.3	0.42	55.3	0.69	45.1	0.78	32.7	0.97	26.7	1.25	43.2	10.69
Mt. Fenny	7420'	8	19.3	6.63	23.8	4.17	25.0	4.94	28.1	3.03	40.3	2.82	46.4	2.70	56.8	10.41	58.5	2.85	46.6	2.85	35.8	3.11	27.6	5.40	19.8	7.39	35.7	44.22

(1) All data is from Climatological Data, U.S. Department of Commerce, U.S. Weather Bureau, Annual Summaries 1966-1973 and Climatic Summary of the United States, U.S. Weather Bureau, Supplement for 1951 through 1960.

(2) Average of the Mean Monthly Temperatures for all years in which measurements were made (°F).

(3) Average Mean Monthly Precipitation for all years in which measurements were made (inches).

(4) Average annual temperature.

(5) Average annual precipitation.

FIGURE 5

MONTHLY PRECIPITATION AS A

PERCENTAGE OF ANNUAL PRECIPITATION

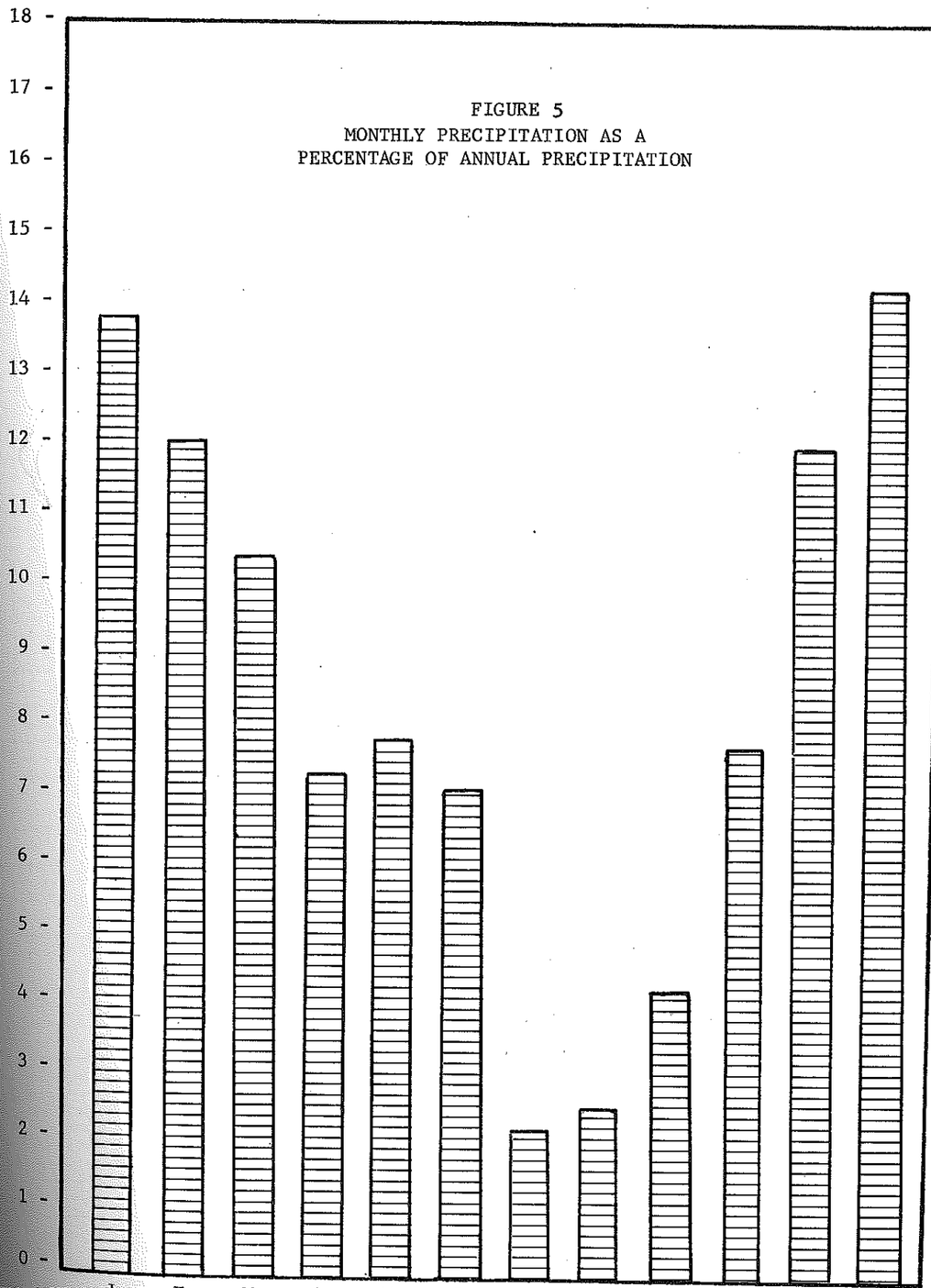


Figure 6
ISOHYETAL MAP

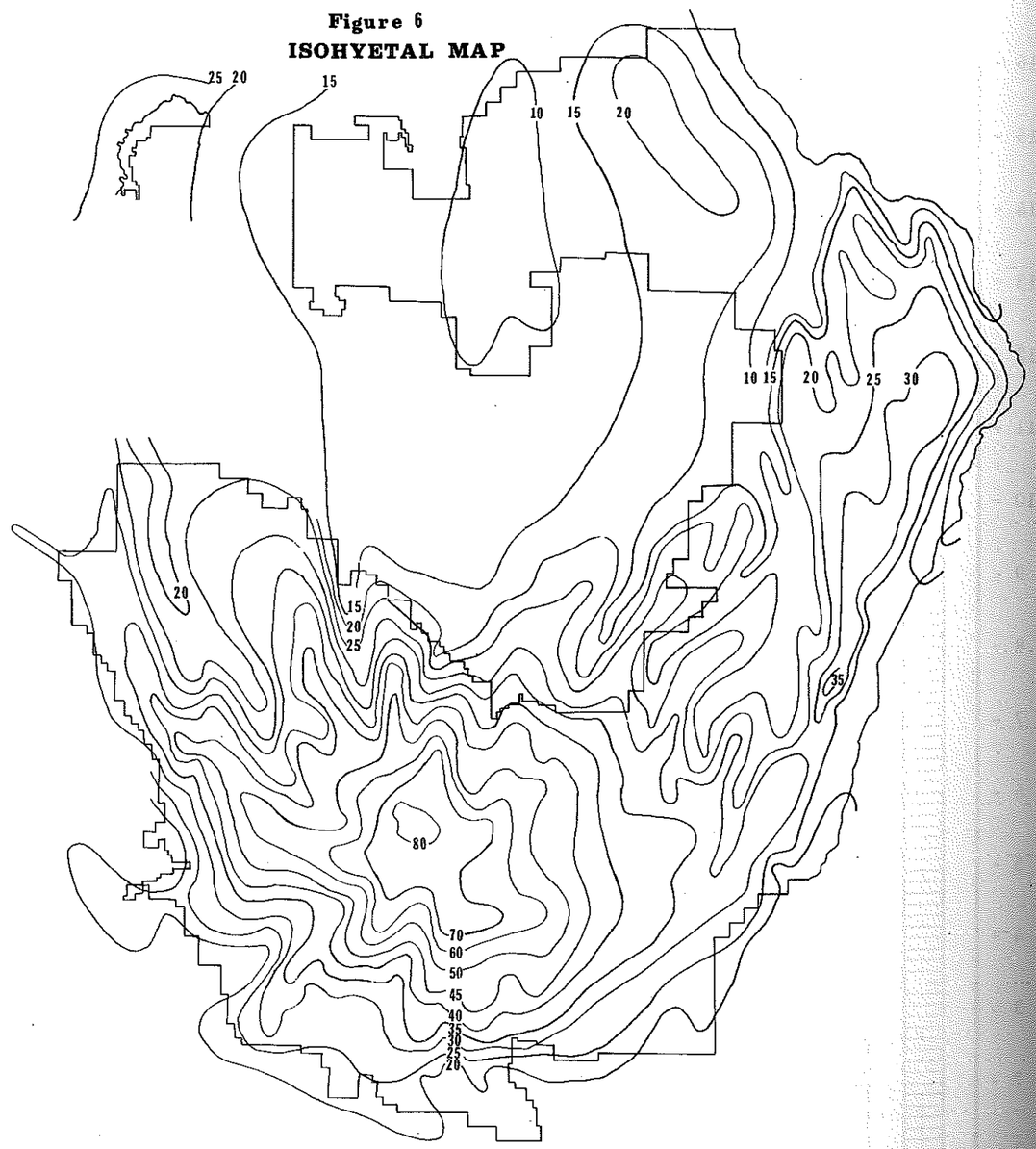
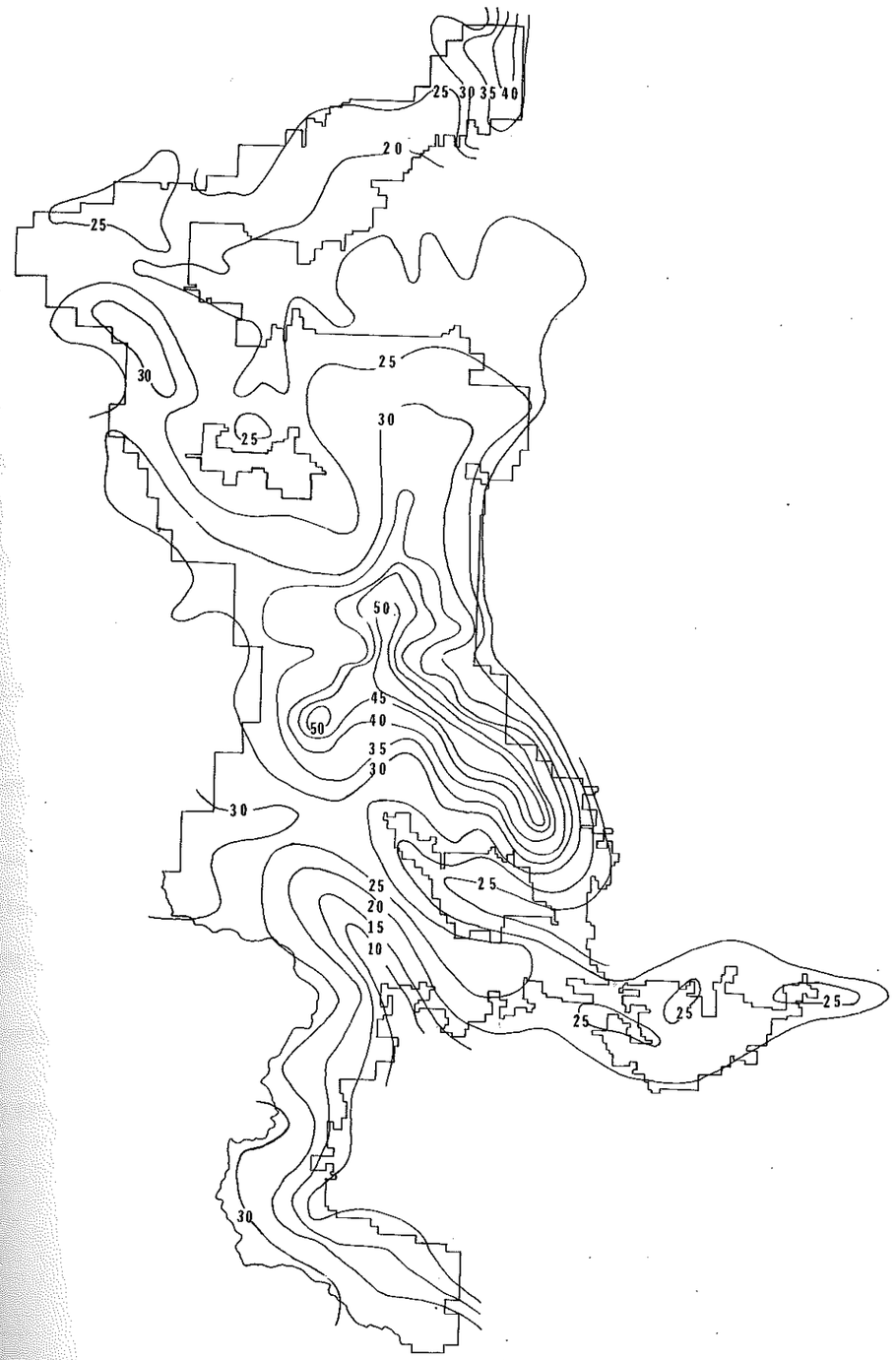


Figure 7
ISOHYETAL MAP



APPENDIX V

DEFINITIONS OF MANAGEMENT INTERPRETATIONS

This appendix contains the definitions for the soil and management interpretations found in the Atlas under "Tables of Management Interpretations". Definitions apply to Erosion and Some Hydrologic Interpretations, Timber Management, Engineering, Recreation and Range and Wildlife Management.

EROSION AND SOME HYDROLOGIC INTERPRETATIONS

Erosion and some hydrologic interpretations include erosion and water management interpretations. Interpretations for erosion include the two major kinds of erosion--surface and mass movement. Surface erosion pertains only to surface soil loss by runoff and overland flow. Mass movement pertains to all types of soil and bedrock movement which occurs below the soil surface such as landslips, slumps, slides, rockfall and land flow.

Natural Stability

This rating is based on the relative stability of the mapping units as they occur in the natural state. This includes any movement or loss other than surface erosion, by slumps, slides, and all kinds of deep-seated failures. This rating applies throughout Region 6.

I. Very stable - No evidence of failure.

II. Stable - Occasional failures are observed.

III. Moderately stable - Several failures are observed.

IV. Unstable - Many failures are observed.

V. Very unstable - Entire area shows evidence of recent and past failures.

Nature of Mass Movement

This is an estimation of the kind and/or size of mass movement observed.

Expected Mass Movement as a Result of Man's Activities

This rating indicates the expected mass movement resulting from man's activities as compared to stability under natural conditions. Ratings are based on soil and bedrock characteristics, slopes, revegetation potential, and effects of timber removal, road construction and fire.

Unchanged - The expected mass movement is relatively unchanged from that of the natural state.

Increased - The expected mass movement is greater than that of the natural state.

Greatly increased - The expected mass movement is much greater than that of the natural state.

Surface Soil Erosion Potential

This rating is based on expected losses of surface soil when all vegetative cover, including litter, is removed. Evaluations of climate, slope gradient and length, soil characteristics, hydrologic characteristics of the soil and bedrock materials of each landtype unit are considered in making ratings.

Very slight - Practically no loss of surface soil materials is expected.

Slight - Little loss of soil materials is expected. Some minor sheet and rill erosion may occur.

Moderate - Some loss of surface soil materials can be expected. Rill erosion and some small gullies or sheet erosion may be occurring. Sheet erosion can be determined by some soil pedestals and observable accumulation of soil materials along the upslope edge of rocks and debris. At this level of erosion there is a possible fertiltiy loss.

Severe - Considerable loss of surface soil materials can be expected. Rill erosion, numerous small gullies or evidence that considerable loss from sheet erosion may occur. Sheet erosion is indicated by frequent occurrence of soil pedestals and considerable accumulation of soil materials along the upslope edge of rocks and debris. This is accompanied by a probable fertility loss.

Very severe - Large loss of surface soil material can be expected in the form of many large gullies and/or numerous small gullies or large loss from sheet erosion. Sheet erosion loss is exhibited by numerous examples of soil pedestals and extensive accumulation of soil materials along the upslope edge of rocks and debris. This is accompanied by a fertility loss.

Subsoil Erosion Potential

This interpretation indicates the potential for subsoil erosion by water for each unit. It includes erosion which takes place after the surface soil has been removed (at least to 1-foot depth) such as in skid trails and firebreaks. Factors considered in making ratings are texture and structure of subsoil materials, slope, permeability, compaction, climate, and landform.

Low - Factors are such that little or no erosion may occur. Very little evidence of erosion.

Moderate - Considerable erosion occurring such as rills and small gullies. Factors indicate considerable erosion is likely to occur.

High - Factors indicate severe erosion may occur.

Suggestions for Controlling Subsoil Erosion

In this column suggestions are given, when applicable, for controlling erosion.

Water Yield Class

This interpretation is an indication of the rate and amount of water yield expected from each soil. It is based on factors such as soil characteristics, infiltration rates, permeability, slope, climate, vegetation, and drainage patterns.

Class I - These soils have a high water detention storage capacity and a low rate of runoff. Little water is yielded to peak flows until detention storage capacity is exceeded or unless the soils are initially saturated or frozen. They are important in sustaining high base flow due to a relatively large volume of water held in detention storage.

Class II - These soils have a moderate water detention storage capacity and a moderate rate of runoff. Water contributes to both peak flows and base flow.

Class III - These soils have a low water detention storage capacity and a high rate of runoff. The storage capacity is low and easily exceeded with most of the water contributing to peak flow. Little water is yielded to sustain base flow.

Bedrock Hydrologic Characteristics

This interpretation indicates the relative capacity of bedrock to store and transmit water. The rating is based on bedrock kind, texture, type and extent of fracturing, frequency of jointing, bedding characteristics, and degree of weathering.

Class I - This indicates that the bedrock has a relatively high capacity to store water. The water transmission rate is low unless the storage capacity is exceeded. Rocks in this class include sandstones because of their texture, fracture, and bedding characteristics, and basalts where water occurs in large tubes and other cavities or in the interflow zone between successive lava flows.

Class II - This indicates that the bedrock has a moderate capacity to store water. The rate of water transmission is moderate. Rocks in this class are generally hard to moderately hard, moderately fine textured, and moderately to highly fractured siltstone, mudstone, pyroclastics, argillite and schist.

Class III - This indicates that the bedrock has a relatively low capacity to store water. The rate of water transmission is rapid. Rocks generally in this class are fractured coarse crystalline (i.e., granite, gabbro and gneiss) and other hard-fractured rocks such as conglomerate.

Bedrock Hydrologic Characteristics (Cont.)

Class IV - This indicates that the bedrock has both low-storage capacity and low rate of water transmission. Rocks in this class are generally highly weathered, fine-textured, and lack open fracture channels.

Hydrologic Group

This interpretation is a grouping of soils into four classes, indicating the general infiltration and water movement ability of the soil and bedrock materials. This method of ratings has been developed by the Soil Conservation Service. The four groups are the standard SCS groupings and definitions.

Group A - Soils having high infiltration rates even when thoroughly wetted, consisting chiefly of deep, well to excessively drained sands and/or gravel. These soils have a high rate of water transmission and would result in a low runoff potential.

Group B - Soils having moderate infiltration rates when thoroughly wetted, consisting chiefly of moderately deep to deep, moderately well to well drained soils, with moderately fine to moderately coarse textures. These soils have a moderate rate of water transmission.

Group C - Soils having slow infiltration rates when thoroughly wetted, consisting chiefly of (1) soils with a layer that impedes the downward movement of water, or (2) soils with moderately fine to fine texture and a slow infiltration rate. These soils have a slow rate of water transmission.

Group D - Soils having very slow infiltration rates when thoroughly wetted, consisting chiefly of (1) clay soils with high swelling potential, (2) soils with a high permanent water table, (3) soils with claypan or clay layer at or near the surface, and (4) shallow soils over nearly impervious materials. These soils have a very slow rate of water transmission.

Silt and Clay Sedimentation Yield Potential

This interpretation indicates the potential for water sedimentation and pollution from silt and clay particles carried in suspension following timber harvest, road construction, or other activities. Factors considered in making ratings are soil texture and structure, drainage patterns, landform and climate.

Low - Sedimentation levels of silt and clay particles are not expected to be significant following management activities. Soils are generally moderately coarse-textured.

Silt and Clay Sedimentation Yield Potential (Cont.)

Moderate - Sedimentation levels of silt and clay particles may be significantly increased following management activities with moderate loss of water quality and damage to fisheries. Soils are generally medium-textured.

High - Sedimentation levels of silt and clay particles are expected to be high following management activities. Streams become turbid and there is considerable loss of water quality and damage to fisheries. Soils are generally fine to moderately fine-textured.

Expected Sediment Size

This interpretation indicates the expected sediment size reaching the streams resulting from erosion of each unit. This Interpretation is a statement of the two dominate separates expected (gravel, sand, silt or clay) from each soil unit. The ratings are presented in two columns. The first column indicates the separates expected from the surface soils, and the second indicates the separates expected from the subsoils.

TIMBER MANAGEMENT

Interpretations for timber management are of two types. One type includes two associated interpretations which indicate the effect on soils and other resources as a result of timber harvest and related activities. The second type includes five interpretations directly affecting timber management as follows: Potential for Desirable Regeneration, Windthrow Hazard, Susceptibility to Brush Revegetation and Susceptibility to Pinegrass Revegetation.

The timber management interpretations are designed to give some broad answers as well as to stimulate further thought on the relationship of timber management and soils. Questions which should continually be asked and answered while preparing plans and follow-up action should include:

1. What methods of harvest can we use to protect the soil resource?
2. How does soil, its characteristics, affect plant and tree growth?
3. What can we do to maintain or improve the soils ability to produce vegetative cover?

Potential Soil and Watershed Impacts from Various Timber Harvest Methods

This interpretation indicates the susceptibility of soil and watershed resources to incur damage from various timber harvest methods. Each soil is evaluated as to the potential impact from each of the following harvest methods: Tractor logging, cable (no suspension), cable (partial suspension), cable (full suspension), and aerial logging. The evaluation of potential impact includes soil and watershed resource damages from timber removal, spur roads, landings and other activities that may be associated with the harvest method being evaluated. The evaluations are based on a full operating season. Damage is caused to soils by creating soil disturbance which may destroy soil structure, cause compaction and increase erosion. This may affect other resources through loss of production, lower water quality and yield, and loss of fisheries. Factors involved in making these ratings are wetness of soil, soil texture and structure, percentage of coarse fragments, slope, drainage, climate, and field observations.

Low - This rating indicates that the potential impacts to soil and watershed resources are minor. Little or no soil damage is expected.

Moderate - This rating indicates that the potential impacts to soil and watershed resources are moderate. Soils and watershed resources have potential to incur moderate damage.

High - This rating indicates that the impacts to soil and watershed resources are major. Excessive damage to soil and watershed resources may occur.

Type of Damage Potential During and Subsequent to Timber Harvest Operations

This indicates the type of soil and watershed resource damage potential on each soil from various harvest methods.

Potential for Desirable Regeneration

This interpretation indicates the potential for each landtype to regenerate desirable species to a satisfactory stocking level as set by the Forest Service. Factors included in this interpretation are soil characteristics, climate, aspect, elevation, frost potential, brush competition, and species.

Low - This rating indicates the potential for regeneration of desirable species is low. Probability of success is very limited. Major regeneration problems can be expected and reseeding or replanting may be required throughout the area. Several years may elapse before a satisfactory stocking level is achieved.

Moderate - This rating indicates that some problems will be encountered in attaining a satisfactory stocking level. Usually regeneration is spotty and some replanting will be necessary.

High - This rating indicates that desirable species regeneration has a high probability of success. Few problems should be encountered in attaining satisfactory stocking levels.

Limitations to Regeneration

This indicates the major limitations to regeneration.

Windthrow Hazard

This interpretation indicates the susceptibility to windthrow for each landtype. It is recognized that catastrophic windthrow resulting from wind storms which can occur anyplace, anytime. Soil and its characteristic are just one element of several which should be considered when opening up a stand to the hazards of just high winds. Windfirmness of trees is often related to the natural density of the stand. When a stand undergoes timber removal the remaining trees and surrounding trees are affected. This interpretation is based solely on the following soil factors: Texture, soil depth, water table, water holding characteristics and effective rooting depth. These factors are considered individually or in combination.

Low - Factors indicate windthrow is not likely to occur with high winds. The effective rooting depth is generally greater than 36 inches.

Moderate - Factors indicate some susceptibility to windthrow, but major problems are not likely. The effective rooting depth is generally between 18 and 36 inches.

High - Factors indicate that windthrow hazard is high. The effective rooting depth is generally less than 18 inches.

Susceptibility to Brush Revegetation

This indicates the susceptibility of each landtype to revegetate naturally by brush following timber harvest operations. These ratings are based on soil characteristics, field observation, slope, aspect, climate, and elevation.

Low - Indicates brush revegetation is insignificant.

Moderate - Indicates that some brush revegetation will occur.

High - Indicates brush revegetation is severe and that it can be highly restrictive for the establishment of adaptable species to a satisfactory stocking level.

Susceptibility to Pinegrass Revegetation

This interpretation indicates the susceptibility of each landtype to revegetate to pinegrass following timber harvest operations. These ratings are based on soil characteristics, drainage, elevation, climate, topographic position and field observations.

Low - Factors do not encourage pinegrass establishment and growth. Little or no pinegrass revegetation occurs.

Moderate - Factors are moderately favorable for pinegrass establishment and growth. Pinegrass revegetation is moderate.

High - Factors are highly favorable for pinegrass establishment and growth. Pinegrass revegetation occurs rapidly. High also indicates that pinegrass could be highly competitive with young seedlings for soil moisture and space.

ENGINEERING

Interpretations for engineering include characteristics for roads, foundations, bedrock, and some miscellaneous interpretations. These are presented in two tables: One table, "Characteristics Pertinent to Roads and Airfields," is a standard engineering table for road construction based on the Unified Soil Classification System. The other table, "General Engineering Interpretations," gives other engineering interpretations which will be useful to engineers and other resource managers. These interpretations are explained and defined in this section. Generally, the following interpretations and ratings are based on the entire landtype unit including soil, bedrock and landform. Some interpretations are based only on the soil material or bedrock material. These are stated in the description for each interpretation. The interpretations pertaining to roads are based on standard Forest Service regulations and construction methods presently used.

Unified and ASSHO Classification

Each soil is classified as to its Unified and ASSHO Classification. Most soils will be classified into one class. Those soils with significant layers of different soil materials will have a classification for each layer designated. The classification will be made for some representative soils by laboratory testing. Those soils not tested will be classified by comparing their properties to those tested.

Suitability for Use as Topsoil Source

This rating evaluates each soil as to its suitability for use as topsoil. It does not specify any particular use of the topsoil. Ratings are based on soil characteristics.

Suited - Soil texture ranges from sandy loam to clay loam; gravel content is less than 30 percent and soil layer is at least 3 feet thick.

Unsuited - This rating indicates the soils do not satisfy the requirements specified under "Suited." However, soils rated "Unsuited" may still satisfy a particular requirement. See the "Table of Soil Characteristics" for soil texture, thickness and gravel content.

Suitability of Soil as Sand and/or Gravel Source

This interpretation indicates the suitability of each soil as a possible source of sand and/or gravel. It does not indicate the kind or quality of sand or gravel, or refer to any specific use of the sand and/or gravel.

Suitability of Soil as Sand and/or Gravel Source (Cont.)

Suited - This rating indicates that sand and/or gravel is present and the following conditions are satisfied: There is a layer present which is composed of 80 percent, by volume, of sand and/or gravel. This layer is at least 4 feet thick.

Unsuited - This rating indicates that sand and/or gravel is generally not present in amounts which satisfy the requirements under "Suited." However, soils rated "Unsuited" may still satisfy a particular requirement. See the"Table of Soil Characteristics"for soil depth and gravel content.

Suitability of Soil as a Possible Clay Source

This rating indicates the suitability of each soil as a possible source of clay. It does not indicate the kind or quality of clay or refer to any specific use of the clay.

Suited - This rating indicates that the soil is a possible source of clay. Soils with this rating have the following: Texture ranges from clay loam to clay. Gravel content is less than 30 percent. This layer is at least 2 feet thick.

Unsuited - Soils with this rating generally are not possible sources for clay.

Suitability of Bedrock for Road Rock

This interpretation indicates the general stability of rock when used as road rock for base course or wearing surface. These ratings are based on rock hardness, density, and susceptibility to weathering and breakdown. Soils are not rated when depth to bedrock is greater than 12 feet. (Cautionary note: This information is for broad planning purposes only. Specific onsite characterization data are required to accurately determine rock suitability.)

Unsuited - Rock is soft and breaks down rapidly under logging traffic.

Poor - Rock is only moderately hard and breaks down easily under logging traffic, usually in one or two years' time.

Fair - Rock is hard and dense but tends to break down under logging traffic after about two to four years' use.

Good - Rock is hard, dense and resists breakdown under logging traffic.

Limitations of Bedrock for Road Rock

This column indicates the major limitation of the bedrock for road rock use.

Estimate of Road Rock Thickness

This interpretation refers to estimated amount of road rock (base course and wearing surface) generally needed on heavy-vehicle, all-weather use roads constructed on each soil. Factors involved in making this interpretation include field observations, texture and plasticity of soil, depth of bedrock, drainage, and kind of subgrade the road generally will have-common material or bedrock. Ratings are based on uncompacted fills and on the use of high quality rock. (Cautionary note: This information is for broad planning purposes only. Specific onsite characterization data are required to accurately determine thickness needs.)

Very thin - Generally less than 6 inches.

Thin - Approximately 6 to 12 inches.

Thick - Approximately 12 to 24 inches.

Very thick - Generally over 24 inches.

Considerations for Road Location and Construction

This column indicates the major considerations for road location and construction through each soil. The rating evaluates the impact of road construction on other resources and/or road construction problems likely to be encountered.

Method of Excavation

This interpretation refers to excavation methods most commonly used and required for each soil. This includes soil, bedrock and cemented and/or compacted layers in the soil. Methods are blading, ripping, and/or blasting. (Cautionary note: These appraisals are subject to change as machinery capabilities change.)

Cutbank and Ditch Erosion Potential

This interpretation indicates the potential for subsoil erosion by running water of each soil. Subsoil refers to that material from approximately the 5-foot depth extending to bedrock. It includes erosion which takes place along road ditches and on cutslopes. Rating is of soil material only and does not apply when cutbank or ditch is in bedrock. Factors considered in making ratings are field observations, texture and structure of subsoil materials, permeability, compaction, and climate.

Low - Factors indicate that little or no subsoil erosion is likely to occur.

Moderate - Factors indicate that the subsoils have moderate erosion potential.

High - Factors indicate that the subsoils are likely to erode severely.

Susceptibility to Cutbank Sloughing and Raveling

This rating evaluates each unit for its susceptibility to sloughing or raveling after excavation. Ratings are based on cutbanks at least 10 feet high. Factors include field observations, soil and bedrock characteristics, backslope ratio, frost action, climate and potential for revegetation.

Low - Sloughing and/or raveling is a minor problem requiring occasional road maintenance.

Moderate - Sloughing and/or raveling causes some damage. Annual road maintenance is usually adequate.

High - Sloughing and raveling occur at a rate that often plugs culverts and fills inside ditches. Frequent road maintenance with heavy equipment such as front-end loader is required.

Estimated Cutslope Ratio

This interpretation estimates the cutslope ratio which generally will result in the most stable cutbank condition. Ratings made are for cutbanks at least 10 feet high and pertain both to soil and bedrock material. Ratings are based on soil and bedrock factors and on observations. (Cautionary note: This information is for broad planning purposes only. Specific onsite characterization data is needed to determine the proper ratio.)

Steep - Cutbank ratio from vertical to ¼:1

Moderate - Cutbank ratio from about ¼:1 to 1½:1

Flat - Cutbank ratio flatter than 1½:1

Probability of Cutbank Failures 1/

This interpretation indicates the probability of failures in cutbanks following road or building excavation. The highest rate of failing will probably occur within the first two years after excavation. On soils rated as having cutbank stability I and II, there should be few failures after the initial two-year period. Soil units rated as having cutbank stability III, IV or V, will experience failures after the initial two-year period. In the case of soils rated with cutbank stability of V, failures can be expected to occur indefinitely.

Failures are considered to be at least 10 cubic yards of material in volume. It should be realized that as the probability of cutbank failures increases, so does the probability that a few of these failures will have volumes in excess of 50 cubic yards, and in some instances there will be massive failure where entire sections of the road are lost.

Ratings are based on cutbanks of at least 10 feet in height, and refer to more than a 50-percent chance of failure.

1/ Applicable to Forest Service class SH, S1, DH and DL roads with cutslope ratios of 1:1 to 3/4:1, and roadbed widths not in excess of 26 feet.

Probability of Cutbank Failures (Cont.)

I. Very Stable - practically no probability of chance of cutbank failures.

II. Stable - probability of no more than 3 failures per mile of road cutbank.

III. Moderately stable - probability of 4 to 8 failures per mile of road cutbank.

IV. Unstable - probability of 9 to 15 failures per mile of road cutbank.

V. Very unstable - probability of more than 15 failures per mile of road cutbank.

Suggestions for Cutbank Stability Problems

This rating gives suggestions, when applicable, to increase stability of cutbanks or reduce damage from raveling and sloughing.

Failure Potential on Road Waste and Fills

This interpretation rates the soil units as to the susceptibility of failure occurring on fill and sidecast waste material and related damage to resources. Failures are defined as a loss or partial loss of road fill or sidecast material on the fill slope. Considered are initial and subsequent failures caused by construction, erosion and additional sidecast during maintenance. Failures result in damage to various resources. Stream sedimentation levels are increased, resulting in an adverse effect on both water quality and fisheries. Timber growth potential is affected as fill slope areas no longer contribute to production. Occasionally the failures do damage to the road itself. The ratings are based on current road construction practices and procedures and on type of soil materials, natural drainage of the site, landform, slope of the fill, and field observation.

Low - Failure on road waste and fills is sufficiently low in frequency and magnitude to result in only minor damage to resource values.

Moderate - Failures on road waste and fills occur with sufficient frequency and magnitude to cause moderate damage to resource values.

High - Failures on road waste and fills occur at a frequency and magnitude sufficient to cause major damage to resource values.

Erosion Potential on Road Waste and Fills

This interpretation rates the soil units as to the susceptibility of erosion occurring on fill and sidecast waste material and related damage to resources. Erosion is a loss of surface soil from fill or sidecast.

Erosion Potential on Road Waste and Fills (Cont.)

This erosion contributes sedimentation to streams. Timber growth potential is affected as fill slope areas no longer contribute to production. The ratings are based on current road construction practices and procedures and on type of soil materials, natural drainage of the site, landform, slope of the fill, and field observation.

Low - Erosion on road waste and fills is sufficiently low to result in only minor damage to resource values.

Moderate - Erosion on road waste and fills occurs with sufficient magnitude to cause moderate damage to resource values.

High - Erosion on road waste and fills occurs at a magnitude sufficient to cause major damage to resource values.

Suitability of Road Waste & Fill Slopes to Seeding

This interpretation indicates the probable success of fill slope seeding. Factors considered in making ratings are soil characteristics, elevation, slope, climate, snowpack, and frost hazard. Ratings are based on current methods and practices of seeding, grass species, fertilizer application and time of seeding.

Poor - Probability of success is low. Seeding generally is not successful and requires three or more reseedings and special treatments.

Fair - Success is likely on about 50 percent of area treated. Requires one or two follow-up treatments. Seeding usually becomes well established within two years. Little follow-up seeding necessary.

Good - Probability of high success. Seeding usually becomes well established within two years. Little follow-up seeding is necessary.

Limitations to Road Waste and Fill Slope Seeding

This indicates the major limitations to success of fill slope seeding.

Suggestions for Road Waste and Fill Slope Seeding

This indicates special treatment to be given, when applicable, to increase the chance of success of fill slope seeding. A statement indicates the necessary requirements other than normal fill slope seeding practices carried on by the Forest.

Suitability of Cutbanks to Seeding

This interpretation indicates the probable success of cutbank seeding. Factors considered in making ratings are soil characteristics, elevation,

Suitability of Cutbanks to Seeding (Cont.)

slope, climate, snowpack, and frost hazard. Ratings are based on current methods and practices of seeding, grass species, fertilizer application and time of seeding.

Poor - Probability of success is low. Seeding generally is not successful and requires three or more reseedings and special treatments.

Fair - Success is likely on about 50 percent of area treated. Requires one or two follow-up treatments. Seeding is usually spotty; some areas become easily established, while others fail completely.

Good - Probability of high success. Seeding usually becomes well established within two years. Little follow-up seeding necessary.

Limitations to Cutbank Seeding

This indicates the major limitations to success of cutbank seeding.

Suggestions for Cutbank Seeding

This indicates special treatment to be given, when applicable, to increase the chance of success of cutbank seeding.

RECREATION

Interpretations for recreation pertain primarily to recreation development. They are based on soil and bedrock properties, drainage, landform and vegetation. Factors such as aesthetics and accessibility are not considered when making these ratings. The following interpretations are some most generally needed for planning recreation developments.

Landtype Suitability for Recreation Area Development

This rating is based on soil and bedrock characteristics and topographic features of each unit as related to recreation development such as campground and picnic sites. Factors important to this interpretation are soil depth, texture, structure, permeability, drainage, topography, and susceptibility to flooding.

Unsuited - This rating indicates that soils and/or topography are of a nature which would prohibit recreation development without extensive modification.

Low - These soil units have major limitations to recreation development but limited development is feasible.

Moderate - This rating indicates that the soil unit is generally suitable for recreation development but has minor limitations.

High - These soils are particularly well suited for recreation development. Generally, they have no limitations.

Landtype Limitations for Recreation Development

This indicates the major soil limitations to recreation development.

Suggested Treatment to Increase Suitability

This indicates, when applicable, the treatment necessary to increase the suitability for recreation development.

Soil and Site Damage Susceptibility

This interpretation applies to recreational areas after development. Each soil that is suitable or can be made suitable for campground development is rated for its susceptibility to damage of soil and/or site by normal recreation use. Site includes vegetation as well as soil conditions. Factors used in determining ratings include erosion potential, soil compactibility, and vegetative growth potential.

Low - These soils resist compaction and have low erosion potential. The native vegetation is hardy and not readily destroyed. These soils will withstand and hold up well under continual use.

Soil and Site Damage Susceptibility (Cont.)

Moderate - These soils are not readily compacted or eroded and vegetative types are somewhat hardy. In general, these soils and site can sustain continual use but require some rehabilitation.

High - These soils are fragile and easily damaged and have vegetation that is not hardy, easily damaged and generally herbaceous. Under normal use, the vegetation will very likely be destroyed, the soil compacted and/or eroded to such a degree that periodic nonuse and major rehabilitation will be required.

Susceptibility to Dustiness

This interpretation pertains only to the soils suitable for recreation development, and applies primarily to unsurfaced roads within recreation areas.

Low - Factors indicate dust will not be a problem.

Moderate - Under normal conditions dust will not be a problem but under heavy use and droughty conditions dust very likely will be a problem.

High - Factors indicate dust will be a problem. Dust abatement measures are necessary under normal conditions and use.

Susceptibility to Muddiness

This interpretation pertains only to the soils suitable, or those that can be made suitable, for recreation development. This interpretation rates each soil as to its susceptibility to becoming muddy. The rating is limited to the surface soil under normal conditions. Factors include soil characteristics, climate and drainage.

Low - Muddiness is not likely to be a problem. Factors indicate soils are not susceptible to muddiness.

Moderate - Soils become muddy at times for short periods, occasionally causing problems. Road rock is usually necessary.

High - Soils are very likely to become muddy and stay muddy for long periods. Road rock is necessary. Campground closure may be necessary during wet periods.

Trail Suitability

This interpretation indicates the suitability of each soil for trails. Factors include soil and bedrock characteristics, drainage, climate, and slope.

Trail Suitability (Cont.)

Poor - These soils have properties which severely limit their use for trails. Extensive treatment measures are required.

Moderate - These soils have some limitations for trail development. Certain treatment measures may be required.

Well - These soils have no limitations for trail development.

Limitations for Trails

This indicates the limitations for trails.

Considerations for Trail Improvements and Protection

This indicates some treatment measures to be considered in improving suitability and protecting trails.

Suitability for Sewage Filter Field

This interpretation evaluates the soil as to its suitability as a sewage filter field. Ratings are based on soil depth, texture, permeability, drainage and slope. Only those soils suitable for recreation development are rated. Onsite investigation is recommended before design or installation of filter system.

Poor - These soils have properties which make them poorly suited as sewage filter fields. Sewage filter disposal in these soils woild be ineffective and create major problems.

Moderate - These soils have properties which limit their use as sewage filter field. They require a large filter area for adequate drainage which limits the capacity of the campground.

Well - These soils are well suited to sewage filter use and offer only minor limitations, if any.

Soil Limitation to Sewage Filter Field Use

This indicates the major limitations to sewage filter field use.

RANGE AND WILDLIFE MANAGEMENT INTERPRETATIONS

Range and Wildlife Management interpretations are presented to enable better rangeland management through utilization of soil information. These interpretations are oriented toward use by domestic livestock, deer and elk.

Limitations for Domestic Livestock and Wildlife Use

This interpretation indicates the major topographic and site limitations existing on the mapping unit that would hinder use by domestic livestock and wildlife. Forage or the potential for establishing good forage is not considered in this interpretation.

Susceptibility to Soil Compaction

This interpretation indicates the soil's inherent ability to resist compaction by hoofed animals. Factors important to this interpretation are: soil texture, structure, bulk density, pore size and distribution, and rate of infiltration.

Low - Factors indicate that the soil will resist compaction.

Moderate - Factors indicate that the soil has tendencies to become compacted under livestock and wildlife use. Time of grazing on these soil units is important.

High - Factors indicate that soil compaction will be severe unless livestock use is withheld until the soils have dried adequately.

Susceptibility to Soil Displacement

This interpretation indicates the general susceptibility of the soil unit to be displaced by livestock grazing. Soil displacement is the downslope movement of soil. Animal trampling causes loosening of soil particles which are moved downslope by gravity, wind and water. Displacement ratings are based on such facts as texture, slope, and field observations.

Low - Factors indicate that displacement is insignificant. Slopes usually are less than 35 percent.

Moderate - Factors indicate that moderate soil displacement will occur.

High - Factors indicate that displacement is severe. Slopes usually exceed 50 percent.

Potential for Range Improvement Through Seeding

This interpretation indicates the potential for each mapping unit to be improved through seeding. Factors used to determine the potential for

Potential for Range Improvement through Seeding (Cont.)

range improvement through seeding are climate, topography, natural vegetation and the soil characteristics that relate to water-holding capacity and fertility.

Low - This rating indicates the potential for a successful grass seeding is low. Probabiltiy of success is very limited.

Moderate - This rating indicates that some problems will be encountered in attaining a satisfactory grass cover.

High - This rating indicates that necessary conditions for a successful grass cover establishment exist.

Limitations to Range Seeding

This interpretation indicates the major limitations to successful range improvement through seeding. Limitations are based on field observations, topography, climate, and soil characteristics.

APPENDIX VI

TERMS AND DEFINITIONS OF MAPPING UNIT CRITERIA 1/

Following is a list of terms and definitions used in Soil Resource Inventories. These terms and definitions are used in compiling information for the Table of Soil Characteristics of Modal Sites; Table of Some Mapping Unit Characteristics, Features and Qualities; Table of Bedrock Characteristics of Mapping Units and the Mapping Unit Descriptions.

1/ Unless otherwise noted, the following definitions were developed for use in Soil Resource Inventories, R-6.

SOIL CHARACTERISTICS

These terms are found in the Table of Soil Characteristics of Modal Sites. They describe morphological properties of the soil.

Soil - Any and all loose, unconsolidated, weathered material on the earth's surface resting on solid, consolidated, unweathered bedrock, regardless of origin, mode of formation, or type of weathering or deposition. Generally includes any material that may be manipulated by hand tools or heavy equipment without the need of blasting except soft unweathered bedrock. In soil horizon designation, soil materials included A, B and C horizons.

Depth of Soil to Bedrock - Distance from soil surface to consolidated, unweathered bedrock. Depth is in inches.

Very shallow - less than 10 inches.

Shallow - 10 to 20 inches.

Moderately deep - 20 to 40 inches.

Deep - 40 to 60 inches.

Very deep - 60 to 144 inches.

Extremely deep - greater than 144 inches.

Depth to Restrictive Layer in the Soil - Distance from soil surface to a layer in the soil that is highly restrictive to drainage, water transmission or root growth. Usually this is a discontinuity or stratification layer, but it may be bedrock. If it is bedrock, depth must be the same as recorded under depth to bedrock. A restrictive layer is generally not a genetic soil horizon except in old soils that have developed claypan, hardpan, or cemented horizons. Depth is in inches.

Litter - Total depth in inches of decomposed and undecomposed organic matter.

Soil Layer - Each soil layer is a homogeneous layer of soil material. Soil layers are described when soil characteristics change significantly and have definite effects on management. Layers are usually at least 12 inches thick, unless material is very contrasting. Each layer may result from stratification or soil formation processes.

Soil Layer Thickness - Thickness of each soil layer in inches.

Soil Layer Thickness Classes - Thickness is in inches.

Very thin - less than 6 inches.

Thin - 6 to 18 inches.

Moderately thick - 18 to 36 inches.

Thick - 36 to 72 inches.

Very thick - greater than 72 inches.

Color - Stated in narrative Munsel notations for each soil layer. Colors are taken of moist crushed soil. Mottling is noted, if present, especially in subsoil layers.

Texture - Relative proportions of sand (2.0 mm.-.05 mm.), silt (.05 mm.-.02 mm.), and clay (less than .002 mm.). Standard USDA textural classes are used for each soil layer.

Textural Classes*- These classes apply when general textural terms are used for the profile sketch in the mapping unit descriptions.

Coarse-textured soils - Sands, loamy sands

Moderately coarse-textured soils - Sandy loam, fine sandy loam

Medium-textured soils - Very fine sandy loam, loam, silt loam, silt

Moderately fine-textured soils - Clay loam, sandy clay loam, silty clay loam

Fine-textured soils - Sandy clay, silty clay, clay

Rock Fragment Quantity, Size, and Shape*- Percent by volume occupied by consolidated fragments larger than sand size (larger 2 mm.).

Size Classes - gravel, 2 mm. - 3 inches; cobbles, 3 inches to 10 inches; stones, greater than 10 inches.

Shape Classes - round, thin, flat, subangular, subround, angular, blocky, etc.

Rock Fragment Classes - Used as an adjective to textural classes. Includes gravel, cobble and stone sizes.

0 - 35% - not noted
35 - 50% - gravelly, cobbly or stony
50 - 80% - very gravelly, very cobbly or very stony
80%+ - extremely gravelly, extremely cobbly or extremely stony

* Standard USDA Handbook 18 Definitions.

Soil Structure*- Includes grade, size and type of structure for each soil layer. If no structure exists, then the soil is massive or single grained. Concretions or shot are recorded, if present. Applies to aggregate structural units (aggregates and peds).

Grade - Degree of aggregation and expression of the differential between cohesion within aggregates and adhesion between aggregates.

Weak - Indistinct peds, barely observable in place.

Moderate - Distinct peds, moderately durable and evident.

Strong - Distinct peds in place, durable.

Size - Refers to size of aggregates according to five size classes:

Very fine - less than 5 mm.

Fine - 5 mm. to 10 mm.

Medium - 10 mm. to 20 mm.

Coarse - 20 mm. to 50 mm.

Very Coarse - greater than 50 mm.

Type - Refers to relative shape of individual aggregates. There are four primary basic shapes:

Platy - Soil particles arranged around a plane, generally horizontal:

Prism-like - Soil particles arranged around a vertical line and bounded by relatively flat surface (prismatic, columnar).

Block-like - Soil particles arranged around a point and bounded by flat or rounded surfaces (angular blocky, subangular blocky).

Spheroidal - Soil particles arranged around a point and bounded by curved or very irregular surfaces (granular, crumb).

Structureless - No observable aggregation or no definite orderly arrangement of natural lines of weakness.

Massive - The soil material is coherent.

Single-grained - The soil material is incoherent.

Compaction - Relative increase in bulk density which is caused by natural pedogenic processes.

* Standard USDA Handbook 18 Definitions.

Degree of Compaction:

Weak - Soil aggregates are easily broken by hand and are usually nonrestrictive to water and roots.

Moderate - Soil aggregates are difficult to break by hand and resist movement and penetration of water and roots. Water may be perched or ponded for short periods of time.

Strong - Soil aggregates cannot be broken by hand. The soil exhibits nearly total restriction to water and root penetration, and usually requires ripping or blasting.

Permeability - Water or air movement in and through the soil material. The classes are based on soil texture, rock fragment content, porosity and bulk density.

Class:

Very slow - very little, if any, water transmission. Generally fine-textured soils - clay. Less than .05 inch/hr.

Slow - little water transmission. Generally moderately fine-textured soils - clay loams and silty clay loams. .05 inch/hr. to 1 inch/hr.

Moderate - good water transmission. Generally medium-textured soils - loams, silt loams. 1 inch/hr. to 5 inches/hr.

Rapid - water transmission too great for optimum growth. Generally moderately coarse-textured soils, sandy loams, gravelly loams. 5 inches/hr. to 10 inches/hr.

Very rapid - excessive water transmission; soil never becomes saturated. Very porous soils. Generally coarse-textured soils, sands and gravels. Greater than 10 inches/hr.

Consistence*- degree of cohesion and adhesion as indicated by the resistance of the soil aggregate to deformation or rupture under various moisture conditions.

Dry:

Loose - noncoherent.

Soft - easily crushes to powder or single grain.

Slightly hard - easily broken between thumb and forefinger.

Hard - can be broken in the hands without difficulty but difficult to break between thumb and forefinger.

Very hard - can be broken in hands without difficulty.

Extremely hard - cannot be broken in hands.

* Standard USDA Handbook 18 Definitions.

Consistence (cont.)

Moist:

Loose - noncoherent.

Very friable - crushes under gentle pressure.

Friable - crushes easily under gentle to moderate pressure between thumb and forefinger.

Firm - crushes under moderate pressure between thumb and forefinger.

Very firm - Crushes under strong pressure, barely crushable between thumb and forefinger.

Extremely firm - crushes under very strong pressure, cannot be crushed between thumb and forefinger.

Wet:

Stickiness - is measured by pressing wet soil between fingers.

Nonsticky - practically no adherence when pressure is released.

Slightly sticky - after pressure, soil adheres to both thumb and finger but comes off one rather cleanly. Does not stretch appreciably.

Sticky - after pressure, soil adheres to both thumb and finger and tends to stretch somewhat before pulling apart from either digit.

Very sticky - after pressure, soil adgeres strongly to both digits and is markedly stretched when they are separated.

Plasticity - is measured by rolling wet soil and observing wire.

Nonplastic - no wire is formable.

Slightly plastic - wire forms, but soil mass easily deformed.

Plastic - wire forms, moderate pressure required to deform soil mass.

Very plastic - wire forms, much pressure required to deform soil mass.

Soil pH 1/ intensity of soil acidity or alkalinity expressed on a scale from 1 to 14:

pH			pH
Extremely acid	- below 4.5	Slightly alkaline	7.4 - 8.4
Strongly acid	- 4.6 - 5.5	Strongly alkaline	8.5 - 9.0
Slightly acid	- 5.6 - 6.4	Very strongly alkaline	Above 9.0

1/ All pH values were taken by the Hellige-Truog.

LANDTYPE CHARACTERISTICS, FEATURES AND QUALITIES

Infiltration Rate - Rate of entry of water into soil surface. The rate is dependent upon the type of surface soil texture, rock fragment content, structure, porosity, bulk density and organic matter content.

Infiltration Rate Classes:

Slow - Water stands on surface for long periods. Soils are fine-textured, poorly aggregated and puddle easily.

Moderate - Water enters soil at commensurated rates of normal rainfall or water application. Water may pond for short periods (a few days) following very intensive rainfall. Soils are medium-textured and well aggregated.

Rapid - Water rarely ponds, enters soil surface very rapidly. Soils are coarse-textured, porous, loose and usually single-grained.

Drainage Class 2/ - The rapidity and extent of removal of water from the soil. Based on soil permeability, infiltration, internal drainage and topographic position.

Poorly drained - Water table at or near the surface a considerable part of the time. Soils of this class usually occupy level or depressed sites and are frequently ponded. Water is removed so slowly that soil remains wet almost all the time.

Somewhat poorly drained - Water removed so slowly that the soil remains wet for significant periods, but not all the time.

Moderately well drained - Soil remains wet for a period somewhat longer (up to one month) than the wet season; may be due in part to a slowly permeable layer, high water table or lateral seepage.

Well drained - Water is removed from soil readily and these soils are saturated only during the wet season for short periods.

Excessively drained - Water is removed from soil rapidly and these soils are rarely ever saturated. Commonly, these soils are coarse-textured or shallow, stony and/or occur on steep slopes.

Major Drainage Intensity and Pattern - Number of drainage miles per square mile and dominant drainage pattern.

Intensity Classes:

Nondissected - 0 to 3 drainage miles per square mile.

Slightly dissected - 3 to 5 drainage miles per square mile.

Dissected - Greater than 5 drainage miles per square mile.

2/ Very poorly drained and somewhat excessively drained classes are not used.

Plant Communities - These designations refer to the most commonly found plant communities as described in the "Plant Communities of the Blue Mountains in Eastern Oregon and Southeastern Washington" by Frederick C. Hall; R6 Area Guide 3-1, September 1973.

Percent Vegetative Cover - Evaluations of total vegetative cover and the cover of three distinct levels of vegetation above the soil surface. Overstory consists of the timber stand canopy. Understory consists of woody shrubs, and timber regeneration. Ground cover consists of ferns, grasses, sedges, and mosses.

Total Ground Cover - Estimated percent of total vegetative cover with overstory, understory and ground cover combined. Maximum of 100 percent.

Vegetative Cover by Each Level - Estimated percent vegetative cover according to species composition, with overstory, understory, and ground cover estimated separately. Maximum of 100 percent for each level.

Root Distribution*- Includes root size, abundance and depth to zone of rooting. Note maximum depth of roots and zone of maximum concentration.

Size:

Very fine - 0.075mm

Fine - 1 to 2mm

Medium - 2 to 5mm

Coarse - over 5mm

Abundance:

Very few - less than 1/unit 3/

Few - 1 to 3/unit

Plentiful - 4 to 14/unit

Abundant - more than 14/unit

Depth:

Recorded depth in inches of zone of rooting. Distance is measured from soil surface to depth of majority of roots.

Landform - refers to the shape and configuration of a specific, identifiable part of the landscape common to the mapping unit.

Slope - Range of slope of landtype.

Aspect - Direction of slope exposure.

Elevation - Altitude above mean sea level expressed in feet.

*Standard USDA Handbook 18 Definitions.

3/ Unit is a square inch for fine to very fine; a square yard for medium and coarse roots.

BEDROCK CHARACTERISTICS

These terms are found in the Table of Bedrock Characteristics of Mapping Units.

Bedrock - Consolidated, competent rock which upon weathering produces loose or unconsolidated soil material. In terminology of soil horizon designation, bedrock is designated at the "R" layer. Bedrock material usually requires ripping and/or blasting. Includes soft materials that are unweathered such as some sedimentary rock which can be bladed. (Example: Sandstone.)

Color - Color is in narrative terms for fresh, unweathered surfaces.

Hardness - Relative rating based on ease of breaking rock with geology hammer:

Hard - Rock cannot be broken or only with great difficulty.

Moderately hard - Rock can readily be broken with hammer but not by hand.

Soft - Rock can be broken by hand.

Degree of Fracturing - Based on the number or frequency of fractures and joints in a rock unit:

Highly fractured - Entire rock unit is completely dissected by fractures and joints less than 1 foot apart.

Moderately fractured - Fractures divide rock unit into units or blocks generally from 1 to 5 feet apart.

Slightly fractured - Only occasional fractures noted.

Massive - No fractures or very few fractures noted.

Fracture System - Pattern which the rock fractures follow. Example: horizontal, platy, vertical, blocky, random, etc.

Fracture Surface - Indicates the characteristics of the fracture surface and void space within fractures.

Regular - Smooth, distinct, sharp, clean-fractured surfaces.

Irregular - Rough, irregular, fragmented fracture surfaces.

Bedrock (Cont.)

Competency - Relative inherent strength of rock as it occurs on the landscape, based on degree of weathering, fracturing, hardness, stability and failures observed:

Competent - No failures within rock unit observed. Rocks of unit are stable and have strong resistance to mass movement.

Moderately competent - Some failures are noted. Rocks of the unit are moderately stable and have some resistance to mass movement.

Incompetent - Failures are common to rock unit. Rocks of the unit are soft, deeply weathered and have high potential for mass movement.

APPENDIX VII

ENGINEERING LABORATORY TEST DATA

This appendix contains standard test data for some representative soils. The analysis was done by the Forest Service Materials Laboratory in Baker.

Report of Laboratory Test Results

Soil No. 33

Location: T3N; R45E; Sec. 10; NE¼ of NE¼	Mechanical Analysis	
Depth: 36" to 48"	Sieve Size	% Passing
Unified Classification: GP-GMu	3	94.6
ASSHO Classification: A-2-6(0)	1½	55.7
Liquid Limit: 33.8	3/4	30.3
Plasticity Index: 8	3/8	22.0
pH (by Photovolt pH meter): 6.4	No. 4	17.9
	10	14.3
	40	11.6
	60	10.8
	100	10.1
	200	9.0

Soil No. 43

Location: T3S; R45E; Sec. 25; NW¼ of SW¼	Mechanical Analysis	
Depth: 20" to 30"	Sieve Size	% Passing
Unified Classification: GMd	3	90.8
ASSHO Classification: A-1-a(0)	1½	73.9
Liquid Limit: 17.4	3/4	67.2
Plasticity Index: N.P.	3/8	61.0
pH (by Photovolt pH meter): 6.1	No. 4	50.9
	10	40.8
	40	27.9
	60	23.0
	100	18.4
	200	14.0

Soil No. 72

Location: T10S; R35½E; Sec. 2; NE¼ of NW¼	Mechanical Analysis	
Depth: 15" to 27"	Sieve Size	% Passing
Unified Classification: SMu	3	100.0
ASSHO Classification: A-2-7(0)	1½	88.9
Liquid Limit: 42.8	3/4	83.0
Plasticity Index: 8	3/8	77.7
pH (by Photovolt pH meter): 6.7	No. 4	71.3
	10	63.4
	40	52.5
	60	47.1
	100	41.3
	200	34.9

Report of Laboratory Test Results

Soil No. 77

Location: T6S; R35E; Sec. 14; NW¼ of SE¼	Mechanical Analysis	
Depth: 12" to 24"	Sieve Size	% Passing
Unified Classification: CH	3	100.0
ASSHO Classification: A-7-5(11)	1½	90.8
Liquid Limit: 83.0	3/4	89.9
Plasticity Index: 49	3/8	87.6
pH (by Photovolt pH meter): 5.2	No. 4	85.3
	10	80.6
	40	70.7
	60	66.1
	100	62.3
	200	58.7

Soil No. 77

Location: T6S; R35E; Sec. 14; NW¼ of SE¼	Mechanical Analysis	
Depth: 48" to 72"	Sieve Size	% Passing
Unified Classification: SMu	3	100.0
ASSHO Classification: A-2-7(4)	1½	92.0
Liquid Limit: 65.5	3/4	87.4
Plasticity Index: 33	3/8	84.5
pH (by Photovolt pH meter): 5.9	No. 4	81.5
	10	75.5
	40	58.5
	60	48.6
	100	40.5
	200	33.8

Soil No. 77

Location: T10S; R37E; Sec. 33; SW¼ of SE¼	Mechanical Analysis	
Depth: 20" to 30"	Sieve Size	% Passing
Unified Classification: CL	3	100.0
ASSHO Classification: A-7-6(18)	1½	100.0
Liquid Limit: 47.9	3/4	99.7
Plasticity Index: 26	3/8	99.6
pH (by Photovolt pH meter):	No. 4	99.5
	10	98.6
	40	94.4
	60	91.6
	100	87.8
	200	82.5

Report of Laboratory Test Results

Soil No. 81

Location: T7S; R46E; Sec. 14; SW¼ of NW¼	
Depth: 14" to 32"	
Unified Classification: GMu	
ASSHO Classification: A-2-6(10)	
Liquid Limit: 36.2	
Plasticity Index: 9	
pH (by Photovolt pH meter): 6.0	

Mechanical Analysis	
Sieve Size	% Passing
3	100.0
1½	67.4
3/4	53.8
3/8	48.4
No. 4	44.9
10	40.8
40	34.3
60	32.7
100	31.1
200	29.3

Soil No. 83

Location: T3N; R45E; Sec. 34; SE¼ of NW¼	
Depth: 4" to 16"	
Unified Classification: ML	
ASSHO Classification: A-5(4)	
Liquid Limit: 40.8	
Plasticity Index: 6	
pH (by Photovolt pH meter): 6.2	

Mechanical Analysis	
Sieve Size	% Passing
3	100.0
1½	100.0
3/4	95.3
3/8	87.7
No.4	81.8
10	75.0
40	70.5
60	69.3
100	67.7
200	64.0

Soil No. 83

Location: T3N; R45E; Sec. 34; SE¼ of NW¼	
Depth: 24" to 42"	
Unified Classification: CL	
ASSHO Classification: A-7-6(17)	
Liquid Limit: 47.5	
Plasticity Index: 22	
pH (by Photovolt pH meter): 6.3	

Mechanical Analysis	
Sieve Size	% Passing
3	100.0
1½	96.7
3/4	92.1
3/8	89.1
No. 4	86.0
10	82.7
40	78.7
60	77.9
100	77.1
200	75.1

Report of Laboratory Test Results

Soil No. 94

Location: T10S; R37E; Sec. 33; SW¼ of SE¼	
Depth: 3" to 11"	
Unified Classification: ML	
ASSHO Classification: A-5(8)	
Liquid Limit: 43.9	
Plasticity Index: 7	
pH (by Photovolt pH meter):	

Mechanical Analysis	
Sieve Size	% Passing
3	100.0
1½	100.0
3/4	100.0
3/8	99.8
No. 4	99.6
10	99.4
40	95.4
60	92.1
100	86.9
200	77.9

Soil No. 94

Location: T5S; R38E; Sec. 33; NW¼ of NW¼	
Depth: 28" to 40"	
Unified Classification: GMu	
ASSHO Classification: A-7-5(11)	
Liquid Limit: 72.8	
Plasticity Index: 33	
pH (by Photovolt pH meter): 5.0	

Mechanical Analysis	
Sieve Size	% Passing
3	100.0
1½	93.4
3/4	81.4
3/8	73.5
No. 4	69.2
10	65.5
40	59.7
60	56.5
100	52.2
200	47.9

Soil No. 99

Location: T7S; R46E; Sec. 23; NW¼ of NW¼	
Depth: 110" to 130"	
Unified Classification: ML	
ASSHO Classification: A-6(7)	
Liquid Limit: 36.2	
Plasticity Index: 11	
pH (by Photovolt pH meter): 6.3	

Mechanical Analysis	
Sieve Size	% Passing
3	100.0
1½	100.0
3/4	100.0
3/8	100.0
No. 4	99.6
10	95.1
40	90.1
60	80.5
100	77.0
200	72.2

Report of Laboratory Test Results

Soil No. 105

Location: T6S; R37E; Sec. 2; NE¼ of NW¼	
Depth:	30" to 46"
Unified Classification:	GMu
ASSHO Classification:	A-2-7(1)
Liquid Limit:	52.0
Plasticity Index:	20
pH (by Photovolt pH meter):	5.1

Mechanical Analysis	
Sieve Size	% Passing
3	84.7
1½	77.6
3/4	59.2
3/8	48.8
No. 4	42.3
10	37.3
40	33.9
60	31.8
100	29.4
200	26.1

Soil No. 106

Location: T3N; R46E; Sec. 11; NE¼ of SE¼	
Depth:	0 to 12"
Unified Classification:	ML
ASSHO Classification:	A-7-5(9)
Liquid Limit:	44.8
Plasticity Index:	11
pH (by Photovolt pH meter):	6.3

Mechanical Analysis	
Sieve Size	% Passing
3	100.0
1½	100.0
3/4	98.0
3/8	96.0
No. 4	94.2
10	90.0
40	83.2
60	80.8
100	78.3
200	74.2

Soil No. 115

Location: T3N; R44E; Sec. 15; SE¼ of SE¼	
Depth:	18" to 29"
Unified Classification:	ML
ASSHO Classification:	A-4(2)
Liquid Limit:	34.4
Plasticity Index:	2
pH (by Photovolt pH meter):	6.2

Mechanical Analysis	
Sieve Size	% Passing
3	100.0
1½	100.0
3/4	99.4
3/8	98.1
No.4	95.7
10	91.1
40	85.1
60	83.2
100	81.4
200	78.3

Report of Laboratory Test Results

Soil No. 162

Location: T9S; R36E; Sec. 2; SE¼ of SW¼	
Depth:	4" to 15"
Unified Classification:	GMd
ASSHO Classification:	A-1-b(0)
Liquid Limit:	25.9
Plasticity Index:	4
pH (by Photovolt pH meter):	5.8

Mechanical Analysis	
Sieve Size	% Passing
3	100.0
1½	66.6
3/4	56.2
3/8	49.3
No. 4	38.8
10	29.1
40	23.3
60	22.1
100	21.3
200	20.2

Soil No. 199

Location: T10S; R35E; Sec. 11; NW¼ of SE¼	
Depth:	24" to 42"
Unified Classification:	CH
ASSHO Classification:	A-7-5(9)
Liquid Limit:	63.2
Plasticity Index:	33
pH (by Photovolt pH meter):	6.2

Mechanical Analysis	
Sieve Size	% Passing
3	100.0
1½	100.0
3/4	99.7
3/8	99.2
No.4	98.7
10	97.5
40	89.0
60	82.8
100	76.9
200	71.6

APPENDIX VIII

SOIL ANALYSIS, FERTILITY AND MANAGEMENT RELATED TO SRI LANDTYPES FROM THE WALLOWA-WHITMAN AND UMATILLA NATIONAL FORESTS

by

J. Michael Geist, John M. Wade, and Lee Ehmer [1/]

Limited information exists which reports physical and chemical soil attributes of Oregon's vast acreages of National Forests. An effort to characterize properties of soils and vegetation of the Blue Mountains has produced some documentation and this effort is continuing (Starkey Soil Survey[2/]; Geist and Strickler 1970; Geist 1973, 1974; Hall 1973; Strickler 1965). Research personnel generally perform intensive studies on small areas, whereas Soil Resource Inventory (SRI) personnel cover large areas and can obtain soil samples keyed to broad landtypes. Thus, there is obvious need to combine efforts in defining soil properties. The data reported adds to the definition of differences and similarities among soils and landtypes of the Blue and Wallowa Mountains. As our understanding of associated plants and soils increases, such contributions will be more meaningful. A good background of soil-vegetation data can provide an information base for predicting plant composition, productivity, etc., particularly where disturbance occurs.

METHODS

Soil samples were taken from uniform soil-vegetative units chosen by Wade and Ehmer and are tied to other SRI data through landtype numbers. Sampling was done by auger with fixed depth increments at five randomly chosen points on a 100-foot transect. Five points masked minor local variations and gave a better average picture of soil properties. Fixed depths insured standardized procedures and avoided horizon designation problems. Special problem locations may also require horizon sampling. Note that soil descriptions were made at road cuts whereas auger samples were taken elsewhere, so the depth data from the two sites may disagree.

Most samples were obtained in 1974. Later data will be reported in the SRI for Umatilla National Forest. We felt it important to present all data currently available from both Forests since they adjoin. Two pit sites

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1/ Research Soil Scientist, Pacific Northwest Forest USFS, Range and Wildlife Habitat Laboratory, La Grande, OR; Soil Scientists, USFS, Wallowa-Whitman NF, Baker, OR and Umatilla NF, Pendleton, OR, respectively.

2/ Soil Survey, Starkey Experimental Forest and Range, Union and Umatilla Counties, Oregon. Soil Conservation Service and Pacific Northwest Forest and Range Experiment Station, USDA Forest Service. Mimeographed, 32 p. 1960

were sampled by Geist in 1973 on the Chesnimnus District. They represent the only grassland samples.

Published average data, based on overstory dominant groups (Geist 1974), were used for comparison of the forest soils sampled. Grassland soils were compared with data in an earlier report (Geist and Strickler 1970). Analytical procedures were consistent with those in cited references.

The Regional publication (Boyer, et al. 1973) on forest fertilization provides background information which will aid the reader in applying the data and recommendations reported herein.

RESULTS

The results are reported by specific soil, depth sampled, and analysis (Table 1). Table 2 indicates the nature of site and vegetation properties.

Average trends noted in published analyses. Departures from these "norms" are noted in the results (Table 1) with expected deficiencies for introduced grasses and forbs seeded following disturbance. Notation of subsoil deficiencies is important since subsoils are frequently exposed in roadbuilding and landing construction . Native plants are generally less responsive to fertilization than introduced species because they are adapted to lower fertility regimes. Criteria for predicting native plant response have not been developed. These will be more complex due to varying specific nutritional requirements.

General Trends -

Soil reaction (pH) generally shows slight increases from the surface downward under ponderosa pine and lodgepole stands but decreases under mixed conifer (associated species) stands. Buried soils may affect these trends upward or downward.

Organic matter (OM) usually declines from the surface down. A sudden increase with subsequent decline occurs in well developed buried soils.

Total nitrogen (N) follows the same trends as organic matter.

Carbon to nitrogen ratios (C:N) decline from the surface down but may fluctuate one or two units with buried soil influences.

Available phosphorus (P) generally declines down the profile.

Extractable cations - potassium (K) usually declines down the profile, and Sodium (Na), Calcium (Ca), and Magnesium (Mg) usually increase; total cations generally increase and frequently reflect changes in clay content. Total extractable cations are used as indicators of the cation exchange capacity.

Calcium to magnesium ratio (Ca:Mg) usually ranges between 1 and 7; with 1 to 5 considered normal and values less than 1 seldom encountered. Values generally decline down the profile.

Specific Soil Properties -

Soil 21 - This grassland soil (scabland) is similar to reference soil data (tentatively considered a Rock Creek soil) though total cations are lower. K and P values are in the low range. A spot test for field responses to K and P is advisable. Additions of N and sulfur (S)[3/] with and without K and P may be necessary.

Soil 24 - This grassland soil (bunchgrass, tentatively considered an Albee soil) is normal except that P values increased with depth and are borderline deficient. Field spot tests for P in combinations with N and S are advisable.

Soil 73[4/] - Trends were opposite to those usually encountered in soils supporting mixed conifer. Values were near or above average except for levels of Ca, Mg, and total cations. General fertility is adequate and balanced. There is evidence of greater than average internal water movement.

Soil 76[4/] - OM, total N, C:N, Ca:Mg, and P show normal trends; pH rises and falls within the normal range. Ca and total cations decline down the profile. P, Ca, Mg, and total cation levels are below average. Expect deficiencies below 24 inches for N, S and P and below 24-36 inches for K. Soil analyses indicate above average internal water movement.

Soil 77[4/] - Trends were normal for soils supporting mixed conifer stands. Values for P, Ca, Mg and total cations were lower than average but are not deficient. The buried soil in this profile is reflected by the increase in Ca, Mg and total cations at the 40-60 inch depth.

Soil 112 - Shows mostly normal trends but data exhibit the influences of buried soil material below 36 inches where pH, OM and C:N values rise. The decline and rise between 0-24 inches for Ca and total cations is fairly common and not detrimental to plant growth. P values are low below 24 inches. Surface soil nutrient status is good.

Soil 112[4/] - This soil shows some chemical similarity to 112 above; however, nutrient levels here are considerably lower overall but not deficient. The buried soil influence here is not as great.

3/ Research indicates a strong association of sulfur and nitrogen deficiencies; hence, sulfur should be included with all nitrogen applications (Geist 1971).

4/ Collected by Lee Ehmer on the Umatilla National Forest.

Soil 135 - Trends are normal. Nutrient status is comparatively low, particularly below 12 inches for OM, N, P and total cations. No cations are deficient but expect marked deficiencies in N, S, and P below 24 inches. pH is somewhat higher than reference data.

Soil 144 - Trends are normal except for a decline in Ca, Mg, and total cation levels; Ca:Mg levels are slightly above average but are not a problem. The upper 12 inches of soil are moderately fertile; however, below this depth, expect deficiencies of N, S and P; general fertility is comparatively low. pH is slightly higher than reference data.

Soil 164 - Trends are normal. Nutrient status is lower than average, notably in OM, total N and total cations--especially for surface soil and for P throughout the profile. Expect N, S and P deficiencies with seeding of disturbed areas.

Soil 169 - This soil is closely related to soil 164. Although the upper profile was not sampled, the lower profile data reflect similarities. The deficiencies expected here are the same as those for soil 164.

Soil 198 - Near average trends are shown except for fluctuations in Ca and abrupt increases in Mg. The latter reflects the serpentine influence. Ca:Mg ratios were also affected by these trends. Values less than 1 are common with serpentine influence. Expect deficiencies in P below 12 inches. No Mg toxicity or nutrient imbalances are expected at this site but may be present within soils of landtypes 191-199. If P is applied, include N and S.

DISCUSSION

Use of fertilizers containing nitrogen alone will generally emphasize other deficiencies and, unless corrected, the lack of these nutrients will limit the benefit of applied N. Further, any time nitrogen is applied, sulfur should also be included. Some nitrogen fertilizers contain sulfur or phosphorus; hence, a separate addition of S and P is not necessary (see fertilizer analyses in Boyer et al. 1973).

Many of the analyses reflect nutrient deficiencies in subsoil materials. Thus, the importance of maintaining topsoil for both its high nutrient concentration and water-holding capacity is evident. One example of topsoil conservation is the removal and subsequent replacement of topsoil on the immediate slash-pile and burn site. This avoids burning of soil organic matter and replaces a rich surface soil for new plants. The same principle can be applied to landings, rock quarries, and major skid trails.

Comparison of soils such as 135, 144 and 198 with collections made on the Starkey Experimental Forest and Range reflect differences in origin. Starkey soils are primarily influenced by volcanic ash, basalt and andesite. Soils 135and 144 reflect the granitic influence and are generally of lower nutrient status in subsurface depths. This indicates topsoil conservation is more critical on the granitic landtypes. Chemical data reported here also reflect various combinations of vegetation, local climate, slope, exposure, internal water movement, etc. However, until adequate samplings are available our interpretive ability is limited. Thus, it is important to continue gathering background data to explain these ecological mysteries.

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Table 1.--Soil Analyses for the Wallowa-Whitman and Umatilla National Forests

Soil number	Depth[1] inches	pH	OM	Total N	C:N	Avail. P (ppm)	Extractable Cations K	Na	Ca	Mg	Total	Ca:Mg
			-------%-------				----------	-----	Meq/100g	-----	----------	
21	0-6	5.0	3.18	0.16	11	10	0.2	0.1	7.0	2.2	9.5	3
24	0-6	5.3	3.32	0.18	10	9	0.7	0.1	8.7	2.8	12.3	3
	6-12	5.3	2.70	.15	10	11	.5	.1	8.2	3.0	11.8	3
	12-24	5.1	2.43	.14	10	15	.7	.1	7.2	2.7	10.7	3
73[2]	0-6	5.6	5.02	0.13	22	75	0.6	0.0	5.6	0.7	6.9	9
	6-12	6.0	2.40	.08	17	49	.5	.0	4.2	.5	5.2	2
	12-24	5.7	1.61	.06	16	37	.6	.0	3.7	.5	4.8	8
	24-36	5.8	1.43	.06	14	64	.7	.0	3.6	.5	4.8	7
76[2]	0-6	5.4	3.22	0.07	27	13	0.6	0.0	2.5	0.5	3.6	7
	6-12	5.8	1.59	.04	21	9	.4	.1	2.9	.5	3.9	5
	12-24	5.6	.85	.03	19	8	.4	.1	1.9	.5	2.9	4
	24-36	5.6	.21	.01	11	2	.2	.1	1.8	.7	2.8	3
	36-48	5.3	.12	.01	11	2	.1	.0	1.5	.7	2.3	2
	48-60	5.0	.09	.01	7	2	.1	.0	1.1	.7	1.9	2
77[2]	0-6	5.9	4.48	0.12	21	26	0.7	0.0	6.5	0.6	7.8	10
	6-12	5.9	2.70	.08	19	16	.6	.0	3.6	.5	4.7	7
	12-24	5.7	1.28	.04	18	12	.3	.0	1.6	.3	2.2	6
	24-36	5.3	.39	.02	10	9	.4	.1	2.5	1.1	4.1	2
	36-48	4.9	.38	.03	9	10	.3	.2	5.0	1.9	7.4	3
	48-60	4.7	.30	.02	8	6	.3	.3	10.7	4.3	15.6	3
112	0-6	5.2	4.95	0.13	21	70	1.3	0.1	8.5	1.9	11.8	4
	6-12	5.0	2.44	.08	17	38	.7	.1	6.6	2.3	9.7	3
	12-24	4.7	1.22	.05	14	16	.4	.2	8.0	3.2	11.8	2
	24-36	4.9	.89	.04	12	9	.4	.4	10.7	4.4	15.9	2
	36-48	6.1	.99	.04	15	6	.6	1.0	18.2	7.6	27.4	2

1/ Samples taken by auger.
2/ Collected by Lee Ehmer on the Umatilla National Forest.

Table 1.--Soil Analyses for the Wallowa-Whitman and Umatilla National Forests (continued)

Soil number	Depth[1/] inches	pH	OM	Total N	C:N	Avail. P (ppm)	K	Na	Ca	Mg	Total	Ca:Mg
			--------%-------				Extractable Cations ----------------Meq/100g----------------					
112[2/]	0-6	5.6	3.90	0.09	25	43	0.8	0.1	4.4	0.5	5.8	9
	6-12	5.8	2.16	.05	23	21	.6	.0	2.9	.4	3.9	7
	12-24	5.8	1.24	.03	25	15	.4	.1	2.0	.3	2.8	6
	24-36	5.6	.68	.03	16	12	.8	.1	4.9	1.2	7.0	4
135	0-6	5.8	1.84	0.04	24	49	1.4	0.1	5.4	1.4	8.3	4
	6-12	6.1	.74	.03	16	35	1.1	.1	4.9	1.4	7.5	4
	12-24	6.3	.48	.02	14	16	.9	.1	5.2	1.7	7.9	3
	24-36	6.5	.23	.01	10	10	.6	.2	7.6	2.6	11.0	3
	36-48	6.7	.18	.01	9	6	.5	.3	9.7	2.9	13.4	3
144	0-6	6.0	3.92	0.09	24	43	1.4	0.1	8.2	1.1	10.8	8
	6-12	6.1	2.68	.07	21	22	1.1	.1	7.1	.8	9.1	9
	12-24	6.1	.96	.04	14	10	.7	.1	5.0	.8	6.6	6
	24-36	6.2	.36	.02	11	4	.4	.1	4.5	1.1	6.1	4
164	0-15	5.5	2.88	0.08	22	12	0.9	0.1	2.9	0.7	4.6	4
	15-21	5.5	1.04	.04	16	2	.3	.1	5.5	1.5	7.4	4
	21-27	5.6	.87	.04	13	1	.3	.2	5.6	1.6	7.7	4
	27-39	6.0	.29	.04	5	1	.2	.2	7.5	2.0	9.9	4
169	16-22	6.0	0.76	0.04	10	2	0.4	0.1	5.7	1.7	7.9	3
	22-30	6.1	.74	.04	11	3	.5	.1	5.5	1.8	7.9	3
198	0-6	5.7	3.56	0.08	26	28	1.2	0.1	8.4	8.5	18.2	1
	6-12	6.0	1.62	.05	20	9	.6	.1	6.4	14.8	21.9	0.4
	12-24	6.3	.70	.03	15	3	.3	.1	7.5	20.7	28.6	0.4

1/ Samples taken by auger.
2/ Collected by Lee Ehmer on the Umatilla National Forest.

Table 2.--Site and Vegetative Information[1/]

Soil Number	Vegetative Type[2/]	Elevation (feet)	Slope (%)	Aspect	Parent Material	Bedrock	Average Depth[3/] to Restriction (inches)	Ash Thickness[4/] (inches)	District
21	GB-91-11	6480	0-5	Variable	Residuum with some ash influence	Basalt	6	--	Chesnimnus
24	GB-49-12	6480	0-5	Variable	Residuum with some ash influence	Basalt	18	--	Chesnimnus
73[5/]	CW-S2-11	4560	34	N	Volcanic ash over residuum	Breccia	30	26	Pendleton
76[5/]	CL-G2-11	5200	4	NE	Volcanic ash over residuum	Tuffs	48	60	Ukiah
77[5/]	CW-S2-11	4960	5	NE	Volcanic ash over residuum	Tuffs	50	36	Heppner
112	CD-S6-11	4200	5	Variable	Volcanic ash over residuum	Basalt	49	35	Bear Sleds
112[5/]	CW-S8-11	5080	2	NE	Volcanic ash over residuum	Basalt	35	30	Heppner
135	CW-G1-12	5000	-	NW	Residuum and Colluvium	Granite	29	--	Unity
144	CW-G1-11	4450	0-20	SE	Volcanic ash over residuum	Granite	26	15	Baker
164	CW-G1-12	4600	30	NE	Volcanic ash over residuum and colluvium	Argillite	27	12	Baker

See footnote at end of table

Table 2.--Site and Vegetative Information[1/] (continued)

Soil Number	Vegetative Type[2/]	Elevation (feet)	Slope (%)	Aspect	Parent Material	Bedrock	Average Depth[3/] to Restriction (inches)	Ash Thickness[4/] (inches)	District
169	CW-G1-12	4900	5-20	N	Volcanic ash over residuum	Argillite	39	15	Baker
198	CD-G1-11	4800	0-25	Variable	Residuum	Serpentine	12	--	Unity

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1/ George Schoenfeld's assistance in describing soils during the 1974 field season is gratefully acknowledged.

2/ Hall, F.C. (1973).

3/ Depth to bedrock or rocky restrictive layer at the road cut.

4/ Distinct ash layer thickness and other special horizon features aid in interpretation of changes in analytical values when fixed depth sampling is used.

5/ Collected by Ehmer on the Umatilla National Forest.

APPENDIX IX

BULK DENSITY

Bulk density - The weight of dry soil per unit volume, usually expressed in grams per cubic centimeter.

Bulk density is related to pore space which is essential for water and air movement. Reduction of pore space through compaction lowers the ability of air and water to move through soil. Compaction (increased bulk density or loss of pore space) can result in increased erosion and loss of productivity.

These determinations were taken for the purpose of establishing a few bench marks.

The procedure used for determining volume in the field was use of a volumeasure. The Forest Service Materials Laboratory in Baker determined weight and made the soil analysis. The results appear in the following table.

Table 3.--Wallowa-Whitman National Forest Bulk Densities

Parent Material	Texture	Gravel	Particle Size Analysis %			Depth of Sample (inches)	Bulk Density (gm/cc)	Soil No.
			Sand	Silt	Clay			
Granodiorite	Sandy loam	5.10	62.07	27.40	10.53	0-4	1.11	135
Granodiorite	Sandy loam	30.26	60.14	28.68	11.18	3-7	1.10	131
Granodiorite	Sandy loam	27.91	58.38	30.52	11.10	3-7	1.20	136
Granodiorite	Sandy loam	35.00	64.31	28.00	7.69	22-26	1.41	131
Granodiorite	Sandy loam	15.92	53.62	39.84	6.54	20-23	1.13	141
Basalt	Loam	30.96	41.63	49.68	8.69	0-4	.86	111
Pyroclastic (Sediment)	Loam	26.19	44.45	39.29	16.26	1-4	.95	92
Pyroclastic (Sediment)	Loam	30.38	35.36	44.53	20.11	2-6	.95	83
Pyroclastic (Sediment)	Loam	19.71	48.94	38.61	12.45	2-6	.96	91
Pyroclastic (Sediment)	Loam	48.91	48.13	33.28	18.59	4-8	1.03	81
Glacial drift	Loam	27.72	48.81	41.51	9.68	12-15	1.22	44
Serpintine	Loam	17.40	47.94	35.11	16.95	½-4	1.25	198
Argillite (surface of buried soil)	Loam	54.40	46.35	40.77	12.88	15-18	1.35	169
Ash	Silt loam	**9.27**	30.56	67.24	2.20	½-3	.82	112
Ash	Silt loam	18.19	31.55	52.56	15.89	1-4	.71	167
Ash	Silt loam	11.35	41.34	51.89	6.77	4-7	.78	111
Ash	Silt loam	17.02	32.51	56.64	10.85	½-4	.75	169
Argillite (surface of buried soil)	Silt loam	25.78	39.37	52.55	8.08	12-16	1.04	167
Basalt	Silt loam	31.77	32.58	57.16	10.26	½-3	1.29	116
Basalt	Silt loam	40.23	43.12	51.86	5.07	2-6	1.34	105
Basalt	Silt loam	17.12	31.23	56.70	12.07	19-23	1.35	111
Basalt	Silt loam	14.12	31.30	55.31	13.39	20-23	.93	115
Basalt	Clay loam	8.32	22.56	50.17	27.27	20.24	1.24	112

APPENDIX X

GLOSSARY

Aeolian - Applied to the erosive action of the wind, and deposits which are due to the transporting action of the wind.

Aerial Logging - Logging systems using helicopters or balloons where logs are lifted vertically and yarded free and clear of the ground.

Alluvium - Fine material, such as sand, silt, or clay that has been deposited on land by streams.

Andesite - A gray to black, dense, fine-grained extrusive igneous rock. Very similar to basalt.

Argillite - A rock derived either from siltstone, claystone or shale, that has undergone additional cementation, pressure and heat which makes it harder than those rocks.

Ash - Uncemented pyroclastic (volcanic ejecta) material consisting of fragments mostly under 4 mm. in diameter. Coarse ash is from ¼ to 4 mm. in grain size; fine ash is below ¼ mm. (Ash on the Wallowa-Whitman is primarily fine in dimension).

Basalt - A dark gray to black, dense, fine-grained extrusive igneous rock. Very similar to andesite.

Basaltic Breccia - A highly-fractured marine basalt with inclusions of angular fragments of other previously formed rocks.

Base Flow - Sustained or fair weather runoff. It is composed of groundwater runoff and delayed subsurface runoff.

Bedrock - The rock that underlies the soil and other unconsolidated material, or that is locally exposed at the surface.

Cable (No Suspension) - Yarding method where logs are dragged on the ground to a landing.

Cable (Partial Suspension) - Yarding method where one end of the log is suspended above the ground surface during the yarding operation.

Cable (Full Suspension) - Logs are yarded free and clear of the ground surface to a landing.

Cirque - A deep, steep-walled recess in a mountain, caused by galcial erosion.

Clay - A soil separate less than .002 millimeters in diameter. As a soil textural class, less than 45 percent sand, and less than 40 percent silt.

Colluvium - Soil material or rock fragments moved downslope by gravitational force in the form of soil creep, slides, and local wash.

Compaction - The packing together of soil particles by forces exerted at the soil surface resulting in increased soil density.

Complex - An association in which two or three landtypes are so intricately mixed that it is not practical to show them separately at the scale of mapping used.

Conglomerate - Rounded waterworn fragments of rock or pebbles, cemented together by another mineral substance.

Critical Soil - The term "critical soil" is frequently used by laymen, but it is a meaningless term unless related to a specific function. Many soils may be critical for one reason or another but different soils may not be critical for the same reasons. For example, a deep, wet, plastic and unstable soil will be critical in relation to road location and stability. This soil is not critical in relation to regeneration and droughtiness problems. Another soil may be very shallow over hard bedrock. This soil is not critical from the standpoint of road stability, but may be critical as to regeneration problems resulting from droughtiness and low fertility. It may also be critical in relation to surface erosion. From these two examples, it becomes obvious that the term "critical soil" must be defined by the user in relation to its intended purpose.

Debris Slide - A rapidly moving slide composed of soil, bedrock or both.

Erosion - The wearing away of the land surface by running water, wind, ice or gravitational creep. Accelerated erosion may result from the activities of man or animals.

Extrusive Bedrock - This applies to those igneous rocks derived from volcanic lavas that cooled on the surface of the earth. This lava cools rapidly and forms fine-textured rocks such as basalt and andesite.

Geomorphology - The study of landforms as they relate to geologic composition and history.

Glacial Drift - The debris deposited by glaciers or by streams directly associated with them.

Glacial Soils - Soils derived from materials transported or influenced by glaciers.

Glaciated Valley - U-shaped valley formerly occupied by a glacier.

Graywacke - A loose and general term for sandstone containing significant quantities of clay materials.

Hummocky - Hilly, uneven landscape resulting from deep-seated soil movement, usually of a rotational nature.

Inclusion - Soil type found within a mapping unit that is not extensive enough to be mapped separately or as part of a complex.

Intrusive Bedrock - This applies to those rocks derived from magmas that have been injected into older rocks at depth without reaching the surface. These magmas are slow-cooling and form coarse-textured rocks, such as granite.

Isohyetal Map - A map with lines along which all points receive the same amount of precipitation.

Landform - Structural configuration of the topography as a result of past and present geological activity.

Landtype - Taxonomic description of a portion of the landscape sufficiently uniform in soil, bedrock and landform so that it can be clearly defined and easily recognized wherever it occurs.

Mapping Unit - Any delineated area shown on a soil map that is identified by a number. A mapping unit may be a landtype or a complex of landtypes with less than 30 percent inclusions.

Massive - Soil structure or bedrock condition in which there is no observable aggregation or no definite orderly arrangement of natural lines of weakness.

Mass Movement - All movement of soil and bedrock materials occurring below the soil surface such as landslips, landflows, rock slides, slumps, etc.

Mass Wasting - Wearing away of the landscape through the process of mass movement. Geologic erosion.

Metamorphosed Intrusive - Intrusive rock altered in composition, texture or internal structure by heat and pressure.

Metasedimentary -Sedimentary rocks partially altered by heat and pressure.

Metavolcanic - Volcanic rocks partially altered by heat and pressure.

Miscellaneous Landtype - A mapping unit for areas of land that have little or no natural soil, or have properties that are too variable and unpredictable for classification.

Outwash - Glacial material swept out, sorted and deposited by water that originated from the melting of glacial ice.

Peak Flow (Peak Runoff) - The greatest water discharge for any single runoff period.

Plastic Soil - A soil capable of being molded or deformed continuously and permanently, by relatively moderate pressure, into various shapes.

Puncheons - Piling or split logs laid horizontally across wet areas.

Pyroclastic - A general term applied to rocks formed from volcanic material that has been explosively or aerially ejected from a volcanic vent.

Residuum - Soil material formed by rock weathering in place.

Rhyolite - A light-colored, fine-grained, acidic, extrusive rock.

Runoff - That part of the precipitation which appears in surface streams of either perennial or intermittent form.

Sand - A soil separate between .05 and 2.0 mm. in diameter.

Sedimentary Rock - Rock formed by deposition of soil and rock particles by water, ice or wind that later solidifies through cementation, ionic exchange or compression.

Serpentine - A rock consisting almost wholly of serpentine minerals derived from the alteration of previously existing olivine and pyroxene.

Shale - Fine-grained rock, softer than slate, consisting of clay minerals and silt, which characteristically splits readily along closely-spaced planes, parallel to stratification.

Sheet Erosion - Uniform removal of surface soil by water flowing overland or by wind.

Silt - A soil separate consisting of particles between 0.002 and 0.05 millimeters in diameter.

Siltstone - A sedimentary rock consisting primarily of silt-size particles.

Slate - Rock formed by the metamorphism of shale. Slate is very fine-grained and exceptionally well-foliated. Because of its excellent foliation, it splits into thin sheets parallel to stratification.

Slump - A deep-seated, slow-moving, rotational failure occurring in plastic materials, resulting in vertical and lateral displacement.

Soil - Any and all loose, incoherent, unconsolidated weathered material on the earth's surface resting on consolidated, weathered or unweathered bedrock, no matter how formed, or origin, or method of weathering or deposition. Generally includes any material that may be moved or broken by hand tools or heavy equipment without the need of blasting except soft, unweathered bedrock. In soil horizon designation, soil materials included A, B and C horizons.

Soil Creep - Slow mass movement of soil material downslope primarily under the influence of gravity, but facilitated by saturation with water and/or by alternating freezing and thawing.

Spot Symbols - Symbols used on soil maps to represent a landscape factor too small to delineate.

Surface Slips - Rapid movement downslope of the surface few feet of soil on steep slopes.

Till - Glacial materials deposited directly by ice with little or no transportation by water. It is generally an unconsolidated, unstratified compact mixture of clay, silt, sand, gravel and boulders.

Toeslope - Portion of a slope that is transitional between the valley floor and the upper slope.

Topography - The relief features or surface configuration of an area.

Tractor Logging - Timber harvest method whereby logs are dragged by a tractor to a loading site.

U-shaped Valley - Descriptive phrase of the cross-profile of a valley which has been carved out by glacial movement.

Vitric tuff - An indurated deposit of volcanic ash dominantly composed of glassy fragment blown out during volcanic eruption.

Volcanic Ejecta - Any and all materials forcibly blown out of volcanic cones, fissures or vents.

Vesicular - Containing many small cavities.

V-shaped Valley - A descriptive phrase of the cross-profile of a valley which has been cut by stream action.