Taxonomic Unit Descriptions

In this section, each soil family or higher category recognized in the survey area is described. The descriptions are arranged in alphabetic order by either their common family name or higher taxonomic classification.

Characteristics of the soil and the material in which it formed are identified. A pedon, a small three-dimensional area of soil, that is typical of the soil in the survey area is described. The detailed description of each soil horizon follows standards in the Soil Survey Manual. Preceeding each pedon description is a brief paragraph describing the soils drainage class and permeability, its parent material, its range in physiographic position, slope, elevation, and climatic conditions as it was mapped in this survey area. Following the pedon description is the range of important characteristics of the soil.

Table 4 lists the approximate acreage of each soil map unit, and identifies its proportionate extent of the survey area. The approximate acreage of each soil type mapped within the survey area can be determined by multiplying the percent of that soil in each detailed map unit description it is named in by the total acreage of that mapping unit, then adding those acreages together.

Table 5 lists the mapping unit numbers in which that soil component (soil family or higher category) is found.

Table 4. - Map Unit Legend, Acreage and Proportionate Extent of the Soils

Map Symbol	Mapping Unit Name	Approx. Acreage	Approx. Survey Area %
101	**Aikman family,** 0 to 2 percent slopes	19,220	1.09
102	**Aikman-Cardon families complex,** 0 to 2 percent slopes	4,920	0.28
103	**Aikman-Barnard families association,** 0 to 2 percent slopes	18,230	1.03
104	**Alcot family, 20 to 40 inch pumice overburden,** 1 to 10 percent slopes	3,890	0.22
105	**Alcot family, 40 to 60 inch pumice,** 5 to 35 percent slopes	4,340	0.24
106	**Alcot-Neer families association, 10 to 20 inch pumice overburden,** 5 to 30 percent slopes	6,760	0.38
107	**Alcot-Sadie families complex,** 1 to 20 percent slopes	9,260	0.52
108	**Alcot-Menzel families complex, 10 to 20 inch pumice overburden,** 1 to 10 percent slopes	3,020	0.17
109	**Alicel family,** 5 to 25 percent slopes	1,370	0.08
110	**Anatone-Bearskin families-Rock outcrop association,** 40 to 70 percent slopes	12,930	0.73
111	**Anatone-Bearskin-Smarts families association,** 2 to 20 percent slopes	6,230	0.35
112	**Anatone-Bearskin-Smarts families association,** 20 to 40 percent slopes	8,760	0.50
113	**Anatone-Merlin families-Rock outcrop association,** 40 to 90 percent slopes	1,450	0.08
114	**Anatone-Patio families-Rubble land association,** 60 to 90 percent slopes	640	0.04
115	**Anatone-Smarts families association,** 5 to 20 percent slopes	4,760	0.27
116	**Anatone-Smarts families association,** 20 to 40 percent slopes	7,410	0.42
117	**Anatone-Smarts families-Rock outcrop association,** 40 to 70 percent slopes	16,880	0.96
118	**Bakeoven family-Lava flow-Lithic Xerorthents, mesic association,** 1 to 15 percent slopes	39,890	2.25
120	**Bakeoven family-Rock outcrop association,** 20 to 60 percent slopes	4,280	0.24
121	**Bakeoven family-Rock outcrop-Wenatchee family association,** 1 to 20 percent slopes	2,420	0.14
122	**Bakeoven-Stukel families-Lava flow association,** 1 to 15 percent slopes	4,350	0.25
123	**Behanin-Cheadle families association,** 10 to 35 percent slopes	3,530	0.20

Map Symbol	Mapping Unit Name	Approx. Acreage	Approx. Survey Area %
124	**Behanin-Cheadle families association**, 35 to 60 percent slopes	2,630	0.15
125	**Behanin deep-Gallatin families complex**, 10 to 35 percent slopes	810	0.05
126	**Behanin deep-Supervisor families complex**, 15 to 40 percent slopes	1,550	0.09
127	**Bertag deep-Cavanaugh-Mascamp families association**, 35 to 60 percent slopes	3,720	0.21
128	**Bertag-Smarts families association**, 10 to 40 percent slopes	2,510	0.14
129	**Bertag-Smarts, deep-Cavanaugh families complex**, 35 to 60 percent slopes	1,540	0.09
130	**Bieber-Barnard families complex**, 1 to 20 percent slopes	21,380	1.21
131	**Bieber-Barnard-Simpson families complex**, 1 to 10 percent slopes	3,750	0.21
132	**Bieber-Deven-Roval families complex**, 1 to 10 percent slopes	46,940	2.65
133	**Bieber-Roval families complex**, 1 to 15 percent slopes	21,130	1.20
134	**Bieber-Roval-Barnard families complex**, 1 to 10 percent slopes	3,800	0.22
135	**Bieber-Roval-Puls families complex**, 1 to 15 percent slopes	11,490	0.65
136	**Cardon family**, 0 to 2 percent slopes	5,780	0.33
137	**Cardon-Jacket-Deven families association**, 5 to 25 percent slopes	550	0.03
138	**Saprists**, 0 to 2 percent slopes	870	0.05
139	**Castlevale-Bakeoven families complex, 2 to 8 inch pumice overburden**, 1 to 10 percent slopes	2,080	0.12
140	**Castlevale-Wenatchee-Searles families complex, 2 to 12 inch pumice overburden**, 1 to 10 percent slopes	3,600	0.20
141	**Cavanaugh-Patio deep families association**, 35 to 65 percent slopes	1,110	0.06
142	**Cheadle-Gallatin families-Rock outcrop association**, 10 to 60 percent slopes	3,220	0.18
144	**Cowiche family**, 1 to 10 percent slopes	3,070	0.17
145	**Cowiche-Casuse families-Rock outcrop, tuff association**, 2 to 30 percent slopes	900	0.05
146	**Cowiche-Simpson families complex**, 1 to 15 percent slopes	8,200	0.46
147	**DeMasters-Merlin-DeMasters deep families association**, 1 to 20 percent slopes	13,980	0.79
148	**DeMasters-Smarts families, deep complex**, 1 to 20 percent slopes	11,300	0.64

Map Symbol	Mapping Unit Name	Approx. Acreage	Approx. Survey Area %
149	**DeMasters-Smarts families, deep complex,** 20 to 40 percent slopes	4,070	0.23
150	**Deven family,** 1 to 10 percent slopes	2,770	0.16
151	**Deven-Bieber-Barnard families complex,** 0 to 5 percent slopes	53,520	3.02
152	**Deven-Bieber-Lawyer families association,** 1 to 10 percent slopes	4,070	0.23
153	**Deven-Bieber-Pass Canyon families association,** 1 to 15 percent slopes	47,960	2.72
154	**Deven-Pass Canyon families complex,** 1 to 10 percent slopes	50,060	2.83
155	**Deven-Pass Canyon-Keating families complex,** 1 to 15 percent slopes	6,500	0.37
156	**Deven-Pass Canyon-Keating families complex,** 15 to 35 percent slopes	16,920	0.96
157	**Deven-Pass Canyon-Keating families complex,** 35 to 60 percent slopes	9,040	0.51
158	**Deven-Puls families association,** 1 to 15 percent slopes	16,200	0.92
159	**Deven family-Rock outcrop association,** 1 to 20 percent slopes	8,580	0.49
161	**Divers-Lapine-Kinzel families association, 2 to 15 inch pumice overburden,** 2 to 30 percent slopes	6,820	0.39
162	**Divers-Lapine-Kinzel families association,** 30 to 55 percent slopes	4,340	0.25
163	**Divers-Lapine families-Rock outcrop association, 5 to 15 inch pumice overburden,** 2 to 30 percent slopes	1,250	0.07
164	**Elmore deep family,** 1 to 15 percent slopes	24,710	1.40
165	**Elmore deep family,** 15 to 40 percent slopes	3,120	0.18
166	**Elmore-Deven-Elmore deep families association,** 1 to 20 percent slopes	14,250	0.81
167	**Elmore-Jacket, deep-Lawyer families association,** 1 to 20 percent slopes	2,300	0.13
168	**Elmore-Jacket, deep-Lawyer families association,** 20 to 40 percent slopes	7,490	0.42
169	**Elmore deep-Elmore family-Lava flow association,** 5 to 30 percent slopes	1,510	0.09
170	**Gallatin-Behanin deep-Duncom families complex,** 5 to 30 percent slopes	3,290	0.19
171	**Gallatin-Cheadle families-Cryoborolls, wet association,** 15 to 40 percent slopes	2,410	0.14
173	**Germany deep-Sadie families complex,** 1 to 5 percent slopes	2,760	0.16
174	**Germany family-Lithic Xerumbrepts-Lava flow association,** 1 to 20 percent slopes	48,340	2.74

Map Symbol	Mapping Unit Name	Approx. Acreage	Approx. Survey Area %
175	**Gwin-Pass Canyon families-Lithic Xerorthents, mesic complex**, 1 to 20 percent slopes	2,110	0.12
176	**Gwin-Pass Canyon families-Lithic Xerorthents, mesic complex**, 20 to 40 percent slopes	6,210	0.35
177	**Gwin-Pass Canyon families-Lithic Xerorthents, mesic complex**, 40 to 70 percent slopes	5,280	0.30
178	**Gwin-Ruckles families-Rock outcrop association**, 40 to 70 percent slopes	2,910	0.16
179	**Hades-Vipont-Anatone families association**, 10 to 30 percent slopes	4,410	0.25
180	**Hiibner-Deven-Keating families complex**, 20 to 60 percent slopes	10,070	0.57
181	**Hiibner-Ruckles families complex**, 15 to 35 percent slopes	3,800	0.22
182	**Holland family, 4 to 15 inch pumice overburden**, 1 to 10 percent slopes	4,050	0.23
183	**Holland deep-Skalan families complex, 8 to 20 inch pumice overburden**, 1 to 10 percent slopes	5,900	0.33
184	**Indian Creek family**, 1 to 5 percent slopes	21,820	1.24
185	**Indian Creek-Puls-Barnard families complex**, 0 to 2 percent slopes	14,720	0.83
186	**Inville-Yallani families complex, 10 to 20 inch pumice overburden**, 2 to 20 percent slopes	4,920	0.28
187	**Jacket-Deven-Hiibner families association**, 1 to 15 percent slopes	3,450	0.19
188	**Jacket-Deven-Hiibner families association**, 15 to 35 percent slopes	21,720	1.23
189	**Jacket-Deven-Hiibner families association**, 35 to 60 percent slopes	4,370	0.25
190	**Jacknife-Aikman families association**, 0 to 5 percent slopes	4,040	0.23
191	**Keating-Deven families association**, 1 to 20 percent slopes	22,050	1.25
192	**Keating-Deven families association**, 20 to 40 percent slopes	4,390	0.25
193	**Kinzel-Lapine-Divers families association, 2 to 12 inch pumice overburden**, 1 to 15 percent slopes	5,030	0.28
194	**Lamondi-Smarts deep families complex**, 2 to 20 percent slopes	4,460	0.25
195	**Lamondi-Smarts deep families complex**, 20 to 40 percent slopes	11,560	0.65
196	**Lamondi-Smarts deep families complex**, 40 to 60 percent slopes	4,870	0.28
197	**Lapine-Divers families association, 10 to 24 inch pumice overburden**, 20 to 40 percent slopes	900	0.05
198	**Lapine-Divers families association, 10 to 24 inch pumice overburden**, 40 to 60 percent slopes	1,500	0.08

Map Symbol	Mapping Unit Name	Approx. Acreage	Approx. Survey Area %
199	**Lapine-Wuksi-Divers families association, 2 to 8 inch pumice overburden,** 5 to 30 percent slopes	2,430	0.14
200	**Lawyer deep-Lawyer family complex,** 1 to 20 percent slopes	6,060	0.34
201	**Lawyer-Elmore families, deep association,** 1 to 20 percent slopes	67,190	3.81
202	**Lawyer-Elmore families, deep association,** 20 to 40 percent slopes	20,240	1.15
203	**Lawyer-Elmore families, deep association,** 40 to 60 percent slopes	4,330	0.25
204	**Lawyer-Elmore-Gwin families association,** 1 to 20 percent slopes	48,740	2.76
205	**Lawyer-Elmore-Gwin families association,** 20 to 40 percent slopes	20,230	1.15
206	**Lawyer-Elmore-Gwin families association,** 40 to 60 percent slopes	3,750	0.21
207	**Lithic Cryochrepts-Cheadle family association,** 10 to 40 percent slopes	820	0.05
208	**Lithic Xerorthents, mesic-Deven family complex,** 1 to 15 percent slopes	1,820	0.10
209	**Lithic Xerorthents, mesic-Lava flow complex,** 1 to 20 percent slopes	1,210	0.07
210	**Lithic Xerorthents, mesic-Xerofluvents, mesic-Aquolls association,** to 20 percent slopes	8,050	0.46
211	**Loberg-Friana-Cheadle families association,** 30 to 65 percent slopes	1,940	0.11
212	**Manila-Merlin-Mascamp families association,** 10 to 35 percent slopes	10,210	0.58
213	**Manila-Merlin-Mascamp families association,** 35 to 60 percent slopes	4,350	0.25
214	**Merlin family,** 1 to 10 percent slopes	780	0.04
215	**Gralic-Loberg families-Rubble land association,** 35 to 80 percent slopes	1,580	0.09
216	**Gralic-Supervisor families complex,** 10 to 35 percent slopes	1,450	0.08
217	**Gralic-Supervisor families complex,** 35 to 60 percent slopes	1,370	0.08
218	**Packwood-Bieber families complex,** 1 to 10 percent slopes	7,390	0.42
219	**Packwood-Ditchcamp families-Rock outcrop complex,** 1 to 10 percent slopes	25,560	1.45
220	**Packwood-Puls families complex,** 1 to 5 percent slopes	12,790	0.72
221	**Pass Canyon-Dishner-Deven families association,** 1 to 20 percent slopes	1,870	0.11
222	**Pass Canyon-Elmore families-Lava flow association,** 1 to 20 percent slopes	35,920	2.04

Map Symbol	Mapping Unit Name	Approx. Acreage	Approx. Survey Area %
223	**Pass Canyon-Elmore-Packwood families association,** 1 to 10 percent slopes	10,960	0.62
224	**Pass Canyon-Fordice-Gwin families association,** 1 to 20 percent slopes	26,000	1.47
225	**Pass Canyon-Fordice-Gwin families association,** 20 to 40 percent slopes	25,730	1.46
226	**Pass Canyon-Gwin-Fordice families association,** 40 to 70 percent slopes	7,340	0.42
227	**Pass Canyon family-Lithic Xerorthents, mesic complex,** 1 to 15 percent slopes	3,310	0.19
228	**Pass Canyon-Los Gatos families complex,** 1 to 20 percent slopes	31,770	1.80
229	**Pass Canyon-Roval families complex,** 1 to 15 percent slopes	6,540	0.37
230	**Patio deep-Gleason-Merkel families complex,** 10 to 40 percent slopes	6,220	0.35
231	**Patio deep-Merkel families complex,** 15 to 35 percent slopes	4,720	0.27
232	**Patio deep-Merkel families complex,** 35 to 60 percent slopes	4,130	0.23
233	**Patio-Smarts-Anatone families association,** 15 to 35 percent slopes	1,470	0.08
235	**Puls-Packwood-Ditchcamp families complex,** 1 to 10 percent slopes	5,320	0.30
236	**Puls-Roval-Dishner families complex,** 0 to 5 percent slopes	47,190	2.67
237	**Ridd-Los Gatos-Gwin families association,** 5 to 35 percent slopes	9,920	0.56
238	**Ridd-Ruckles-Keating families complex,** 1 to 20 percent slopes	1,770	0.10
239	**Rock outcrop-Bakeoven-Wenatchee families association,** 20 to 60 percent slopes	5,460	0.31
240	**Rock outcrop-Rubble land-Bakeoven family association,** 40 to 90 percent slopes	4,880	0.28
241	**Rock outcrop-Rubble land-Cheadle family association,** 60 to 100 percent slopes	7,670	0.43
242	**Roval-Deven families association,** 1 to 10 percent slopes	5,360	0.30
243	**Roval-Pass Canyon families complex,** 1 to 15 percent slopes	35,610	2.02
244	**Ruckles-Bieber families complex,** 2 to 30 percent slopes	2,340	0.13
245	**Ruckles-Gwin families-Rock outcrop association,** 20 to 40 percent slopes	6,480	0.37
246	**Menzel-Holland families, 4 to 15 inch pumice overburden-Rock outcrop association** 15 to 40 percent slopes	1,680	0.10
247	**Searles-Gwin families-Lava flow complex,** 1 to 10 percent slopes	8,780	0.50

Map Symbol	Mapping Unit Name	Approx. Acreage	Approx. Survey Area %
249	**Sheld-Ahart families association,** 2 to 20 percent slopes	2,970	0.17
250	**Simpson family,** 1 to 10 percent slopes	2,810	0.16
251	**Simpson-Deven families association,** 1 to 20 percent slopes	23,420	1.33
252	**Smarts deep-Smarts family complex,** 2 to 20 percent slopes	30,220	1.71
253	**Smarts deep-Smarts family complex,** 20 to 40 percent slopes	5,770	0.33
254	**Smarts-Bertag-DeMasters families, deep association,** 10 to 35 percent slopes	6,600	0.37
255	**Smarts deep-Cavanaugh families complex,** 10 to 35 percent slopes	1,150	0.07
256	**Smarts deep-Cavanaugh families complex,** 35 to 60 percent slopes	2,100	0.12
257	**Smarts-Mascamp families association,** 40 to 60 percent slopes	6,650	0.37
258	**Smarts-Mascamp-DeMasters deep families association,** 2 to 20 percent slopes	11,050	0.63
259	**Smarts-Mascamp-DeMasters deep families association,** 20 to 40 percent slopes	11,720	0.66
260	**Stonewell family, 40 to 60 inch pumice,** 15 to 40 percent slopes	7,870	0.45
261	**Stonewell-Yallani families association, 6 to 20 inch pumice overburden,** 5 to 30 percent slopes	5,060	0.29
262	**Stonewell-Yallani families association,** 35 to 70 percent slopes	4,920	0.28
263	**Stonewell-Yallani families-Lithic Xerorthents, frigid association,** 30 to 55 percent slopes	4,020	0.23
264	**Stonewell-Yallani-Zynbar families association,** 2 to 20 percent slopes	3,010	0.17
265	**Stonewell-Zynbar families association,** 15 to 35 percent slopes	2,230	0.13
266	**Stukel family-Lava flow association,** 1 to 20 percent slopes	4,860	0.28
267	**Stukel-Los Gatos-Pass Canyon families complex,** 1 to 10 percent slopes	11,100	0.63
268	**Supan-Supan deep-Pass Canyon families association,** 1 to 20 percent slopes	47,650	2.70
269	**Supervisor-Cheadle families-Rock outcrop association,** 15 to 35 percent slopes	7,250	0.41
270	**Supervisor-Cheadle families-Rock outcrop association,** 35 to 60 percent slopes	5,180	0.29
271	**Supervisor-Cheadle families-Rock outcrop association,** 60 to 90 percent slopes	1,240	0.07
272	**Rock outcrop, tuff-Lithic Xerorthents, frigid complex,** 60 to 100 percent slopes	11,110	0.63

Map Symbol	Mapping Unit Name	Approx. Acreage	Approx. Survey Area %
273	**Vipont-Ginser-Anatone families association**, 15 to 40 percent slopes	3,560	0.20
274	**Aquolls**, 0 to 5 percent slopes	5,010	0.28
275	**Woodhurst-Behanin deep families complex**, 10 to 35 percent slopes	2,950	0.17
276	**Wrentham-Bakeoven families association**, 10 to 40 percent slopes	5,270	0.30
277	**Yallani-Sheld families complex**, 5 to 30 percent slopes	3,330	0.19
278	**Yallani-Inville families complex, 8 to 20 inch pumice overburden**, 5 to 30 percent slopes	3,900	0.22
279	**Yallani-Stonewell families association**, 15 to 35 percent slopes	1,720	0.10
280	**Wapal-Anatone-Patio deep families association**, 60 to 90 percent slopes	940	0.05
281	**Wapal-Patio deep families association**, 15 to 35 percent slopes	2,610	0.15
282	**Wapal-Patio deep-Anatone families association**, 35 to 60 percent slopes	7,050	0.40
V	**Lava flow rock**	32,390	1.83
W	**Water**	38,270	2.17
	Total	1,764,960	100.00

Table 5. - Soil Components in Map Units

(Miscellaneous areas and minor components are not included)

Soil Name	Map Unit
Ahart family	249
Aikman family	101,102,103,190,
Alcot family	104,105,106,107, 108
Alicel family	109,
Anatone family	110,111,112,113, 114,115,116,117, 233,273,280,282
Aquolls	210,274,
Bakeoven family	118,120,121,122, 139,239,240,276,
Barnard family	103,130,131,134, 151,185
Bearskin family	110,111,112,
Behanin family	123,124,125,126 170,275,
Bertag family	127,128,129,
Bieber family	130,131,132,133, 134,135,151,152, 218,
Cardon family	102,136,137,
Castlevale family	139,140,
Casuse family	145,
Cavanaugh family	127,129,141,
Cheadle family	123,124,142,171, 207,211,241,269, 270,271,
Cowiche family	144,145,146
Cryoborolls, wet	171,
DeMasters family	147,148,149,
Deven family	132,137,150,151, 152,153,154,155, 156,157,158,166, 180,187,188,189, 191,192,208,221
Dishner family	221,236,
Ditchcamp family	219,235,
Divers family	161,162,163,193, 197,198,199,
Duncom family	170,
Elmore family	164,165,166,167, 168,169,201,202, 203,204,205,206, 222,223,
Fordice family	224,225,226,
Friana family	211,
Gallatin family	125,142,170,171,
Germany family	173,174,
Ginser family	273,
Gleason family	230,
Gralic family	215,216,217,
Gwin family	175,176,177,178, 204,205,206,224, 225,226.237,
Hades family	179,

Soil Name	Map Unit
Hiibner family	180,187,188,189,
Holland family	182,183,
Indian Creek family	184,185,
Inville family	186,278,
Jacket family	137,167,168,187, 188,189,
Jacknife family	190,
Keating family	155,156,157,180, 181,191,192,238,
Kinzel family	161,162,193,
Lamondi family	194,195,196,
Lapine family	161,162,163,193, 197,198,199,
Lawyer family	152,167,168,200, 201,202,203,204, 205,206,
Lithic Cryochrepts	207,
Lithic Xerorthents	118,175,176,177, 208,209,210,227, 272,
Lithic Xerumbrepts	174,
Loberg family	211,215,
Los Gatos family	228,237,
Manila family	212,213,
Mascamp family	127,212,213,
Menzel family	108,
Merkel family	230,231,232,

Soil Name	Map Unit
Merlin family	113,147,212,213, 214,
Neer family	106
Packwood family	218,219,220,223, 235,
Pass Canyon family	153,154,155,156, 157,175,176,177, 221,222,223,224, 225,226,227,228, 229,
Patio family	114,141,230,231, 232,233,280,281, 282,
Puls family	135,158,185,220, 235,236,
Ridd family	237,238,
Roval family	132,133,134,135, 229,236,
Ruckles family	178,181,238,
Sadie family	107,173,
Saprists	138,
Searles family	140,
Sheld family	277,
Simpson family	131,146,
Skalan family	183,
Smarts family	111,112,115,116, 117,128,129,148, 149,194,195,196, 233,

Soil Name	Map Unit
Stonewell family	279,
Stukel family	122,
Supan family	268
Supervisor family	126,216,217,269, 270,271,
Vipont family	179,273,
Wapal family	280,281,282,
Wenatchee family	121,140,239,
Woodhurst family	275,
Wrentham family	276,
Wuksi family	199,
Xerofluvents	210,
Yallani family	186,277,278,279,
Zynbar family	

AHART FAMILY

The Ahart family consists of deep, well drained soils formed from alluvium and in material weathered from ash and basalt. Permeability is moderate. These soils are on 2 to 10 percent slopes and occur on toeslopes and draws of volcanic mountain uplands at 5600 to 6200 feet elevation. The climate is cool with 40 to 44°F mean annual air temperature and 30 to 40 inches annual precipitation which falls mostly as snow during winter. The frost free season is 70 to 100 days.

Taxonomic Class: Medial, frigid, Andic Xerumbrepts.

Reference Pedon: Ahart family gravelly fine sandy loam on a southwest facing 4 percent mountain toeslope at 5770 feet elevation under an open white fir forest with rabbitbrush, snowbrush, Ross's sedge and bunch grass understory. Soil was dry in the upper 3 inches when described on 7/10/80. (Colors are for dry soil unless otherwise stated.)

01–1/2 to 0 inches; white fir needles and grass duff.

A11–0 to 3 inches; brown (10YR 5/3) gravelly fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine and very fine granular structure; soft, very friable, non-sticky and non-plastic; 20 to 25 percent cinder and pumice gravel by volume; many very fine and fine, and few medium roots; slightly acid (pH 6.2); weakly smeary; gradual wavy boundary.

A12–3 to 12 inches; brown (10YR 5/3) gravelly fine sandy loam, dark brown (10YR 3/3) moist; very weak fine and medium subangular blocky structure which parts into weak fine granular; soft, very friable, non-sticky and non-plastic; 15 percent cinder and basalt gravel by volume; many very fine and fine, common medium and few coarse roots; slightly acid (pH 6.2); weakly smeary; gradual wavy boundary.

B2–12 to 28 inches; brown (10YR 5/3) gravelly fine sandy loam, dark yellowish brown (10YR 3/4) moist; weak medium subangular blocky structure; soft, very friable, non-sticky and non-plastic; 15 percent cinder and basalt gravel by volume; common very fine, fine and medium and few coarse roots; medium acid (pH 6.0); weak to moderately smeary; gradual wavy boundary.

C1–28 to 60 inches; light yellowish brown (10YR 6/4) gravelly fine sandy loam, dark yellowish brown (10YR 4/4) moist; massive; soft, very friable, non-sticky and non-plastic; 30 to 35 percent gravel of weathered cinder and pumice by volume; few to common very fine and fine and few medium and coarse roots; medium acid (pH 6.0); moderately smeary.

Reference Pedon Location: Siskiyou County, California, about 1800 feet east and 1500 feet north of the southwest corner of Section 1, T.42N., R.3E.

Range of Characteristics: The Ahart family soils are deeper than 40 inches to basalt or unweathered ash. The mean annual soil temperature at a depth of 20 inches is 42 to 47°F. The 4 to 12 inch soil moisture control section is moist in all parts from about November 15 through May 30. It is dry in all parts from about August 1 through October 20. The soil temperature exceeds 41°F. from May 15 through November 15 and exceeds 47°F. from June 15 through October 15 in most years. The average content of coarse fragments in the 10 to 40 inch control section is 15 to 35 percent by volume. The bulk density of the soil fine earth fraction is estimated to be between 0.80 and 0.95 at 1/3 bar water tension and the ratio of measured clay to 15 bar water is less than 1.25 normally in all parts of the upper 30 inches of soil. The estimated base saturation in the A horizon is between 30 and 50 percent by the ammonium acetate method. The soil has weak to moderate smeary consistence throughout and the soil pH is slightly to medium acid.

The A horizon is 8 to 24 inches thick. Soil colors are 10YR 4/4, 5/3, 5/4; 7.5YR 4/4, 4/6; 5YR 4/4 dry and 10YR 3/2, 3/3; 7.5YR 3/2; 5YR 3/3 moist. Texture is sandy loam or fine sandy loam and normally contains between 15 and 30 percent gravel and cobbles. It has weak granular and subangular blocky structure and soil pH is slightly acid to medium acid.

The B horizon has dry color of 10YR 5/3, 5/4, 5/6, 6/4; 7.5YR 3/4 and 10YR 4/3, 3/4, 4/4, 4/6; or 5YR 3/4 moist. Texture is loam, sandy loam or fine sandy loam and contain between 15 and 35 percent by volume gravel and cobbles. It has weak to moderate subangular blocky structure and soil pH is slightly acid to medium acid.

The C horizon is sandy loam or fine sandy loam and contains between 25-45 percent by volume gravel and cobbles. Soil colors are 10YR 6/4, 6/6, 7/4 dry and 10 YR 4/4, 4/6, 5/4, 5/6 moist. It is massive and soil pH is slightly acid to medium acid.

AIKMAN FAMILY

The Aikman family consists of deep and moderately deep, moderately well drained soils formed in clayey alluvium derived from basalt. Permeability is very slow. These soils are on slopes of 0 to 2 percent and occur on alluvial flood plans and drainages at elevations of 4300 to 6000 feet. The climate is cool with annual precipitation of 12 to 20 inches which falls mostly as snow during the winter. Mean annual air temperature is 44 to 49°F. The frost free season is 80 to 110 days.

Taxonomic Class: Fine, montmorillonitic, mesic, Typic Chromoxererts.

Reference Pedon: Aikman family silty clay on a nearly level alluvial drainageway at 5100 feet elevation under silver sagebrush, timothy and various wet meadow grasses. Soil was moist below 14 inches when described on 9/6/79. (Colors are for dry soil unless otherwise stated.)

A1–0 to 1 inch; dark gray (10YR 4/1) silty clay, very dark grayish brown (10YR 3/2) moist; moderate to strong fine and medium granular structure; very hard, firm, very sticky and very plastic; many fine, very fine and few medium roots; cracks are 2 inches wide and 10 to 24 inches between cracks; non-effervescent; neutral (pH 6.6); clear smooth boundary.

AC–1 to 4 inches; dark grayish brown (10YR 4/2), silty clay, very dark grayish brown (10YR 3/2) moist; moderate to strong, fine and medium platy structure parting to moderate to strong fine and medium granular; very hard, firm, very sticky and very platic; many fine, very fine and few medium roots; common fine and few medium tubular pores; cracks are 2 inches wide; non-effervescent; neutral (pH 7.0); clear smooth boundary.

C1–4 to 14 inches; dark grayish brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; strong coarse and very coarse prismatic structure parting to strong medium angular blocks; slickensides on ped faces; very hard, firm, very sticky and very plastic; common to many fine and very fine and few medium roots; common fine and few medium tubular pores; cracks are 1 to 2 inches wide; non-effervescent; neutral (ph 7.0); clear wavy boundary.

C2–14 to 42 inches; grayish brown (10YR 5/2) silty clay, dark grayish brown (10YR 4/2) moist; moderate to strong, medium and fine angular blocky structure; slickensides on ped faces; very hard, firm, very sticky and very plastic; common very fine and fine roots; common fine and few medium tubular pores; cracks are less than 1/2 inch to 1 inch wide; non-effervescent; mildly alkaline (ph 7.4); clear wavy boundary.

C3–42 to 60 inches; dark grayish brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; massive, extremely hard, very firm, very sticky and very plastic; few fine and very fine roots, few very fine tubular pores; non-effervescent; neutral (pH 7.0).

Reference Pedon Location: Modoc County, California, about 1200 feet east and 400 feet north of the southwest corner of Section 25, T.47N., R.11E.

Range of Characteristics: Depth to bedrock is typically greater than 40 inches with some pedons in the 20-40 inch depth normally found along the parameter of units. Clay content in the control section ranges from 40-60 percent. The Aikman soils have surface cracks of about 1/2 inch to 2-1/2 inches wide and extend to depths of greater than 20 inches which open and close at least once each year and remain open during the period of mid-July through mid-October and remain closed for the rest of the year. Intersecting slickinsides or pressure faces are common between the 4 to 42 inch soil depth. The annual soil temperature at the 20 inch depth is estimated to range between 48 to 52°F. The soil between depths of 4 to 12 inches is usually dry in all parts from July 15 through October 15 and is moist in some or all parts all the rest of the year. Rock fragments can make up to 20 percent of the surface horizon and are mostly rounded basalt cobbles and stones.

The A horizon is 1 to 5 inches thick and has dry color of 10YR 5/4, 5/3, 5/2, 4/3, 4/2, 4/1 and moist color of 10YR 4/2, 4/1, 3/2, 3/3, or 3/4. Texture is silty clay or clay. Structure is moderate to strong granular and soil pH is neutral to slightly alkaline.

The C horizon has dry color of 10YR 5/4, 5/3, 5/2, 4/3, 4/2 and moist color of 10YR 4/3, 4/2, 3/3, or 3/2. The moist value is 2 or 3 within the top 12 inches of the soil surface. Texture is silty clay or clay. Some pedons have a clay loam or gravelly clay loam IIC horizon below 30 inches.

Structure is platy, prismatic, angular blocky or massive and soil pH ranges from neutral to mildly alkaline. Calcium carbonate accumulations may be present below 30 inches in some pedons.

ALCOT FAMILY

The Alcot soils consist of deep, somewhat excessively drained soils that formed in alluvium derived from volcanic ash, cinders and geologically recent pyroclastic pumice. Permeability is rapid in the pumice material, if present, and moderately rapid below. These soils are found on old alluvial fans on basalt plateaus and sideslopes of volcanic mountain uplands and have slopes of 1 to 35 percent. Elevation is 4200 to 5500 feet. The annual precipitation is 16 to 30 inches most of which falls in winter as snow. The frost free season is 80 to 110 days. Mean annual air temperature is 44-48°F.

Taxonomic Class: Cindery, mesic, Typic, Xerorthents.

Reference Pedon: Alcot family gravelly loamy coarse sand (pumice overburden phase) on a nearly level basalt plateau with a geologically recent pumice deposit at 4200 feet elevation under an open ponderosa pine forest with a bitterbrush understory. Soil was dry throughout when described on 10/11/78. (Colors are for dry soil unless otherwise stated.)

01–1 to 0 inches; Ponderosa pine needles and twigs.

A1–0 to 6 inches; grayish brown (10YR 5/2) gravelly loamy coarse sand pumice material; very dark grayish brown (10YR 3/2) moist; single grained loose; non-sticky and non-plastic; common fine and very fine and few to common medium and coarse roots; 30 percent by volume pumice gravel less than 3/4 inch in diameter; non-effervescent; neutral (pH 6.6); clear smooth boundary.

C1–6 to 20 inches; very pale brown (10YR 8/3) extremely gravelly coarse sand very pale brown (10YR 7/3) moist; single grained; loose; non-sticky and non-plastic; few to common fine and very fine and few medium and coarse roots; 85 percent by volume pumice gravel less than 3/4 inch in diameter; non-effervescent; neutral (pH 6.7); abrupt smooth boundary.

IIA1b–20 to 22 inches; light yellowish brown (10YR 6/4) very gravelly sandy loam, dark yellowish brown (10YR 3/4) moist; weak fine and medium subangular blocky structure parting to moderate fine and very fine granular; soft; very friable; slightly sticky and non-plastic; common fine and very fine and few medium and coarse roots; 40 percent by volume pumice and ash gravel less than 3/4 inch in diameter; common to many fine and very fine tubular pores; non-effervescent; neutral (pH 6.8); clear smooth boundary.

IIAC–22 to 33 inches; light yellowish brown (10YR 6/4) very gravelly sandy loam, dark yellowish brown (10YR 4/4) moist; weak fine and medium subangular blocky structure; soft; very friable; slightly sticky and non-plastic; common fine and very fine roots and few to common medium and coarse; gravel 40 percent by volume of ash material less than 3/4 inch in diameter; common fine and very fine tubular pores; non-effervescent; neutral (pH 6.8); gradual wavy boundary.

IIC1–33 to 53 inches; brownish yellow (10YR 6/6) very gravelly sandy loam, dark yellowish brown (10YR 4/6) moist; massive; soft; very friable; slightly sticky and non-plastic; few to common fine and very fine and few medium and coarse roots; 45 percent gravel by volume of ash material less than 3/4 inch in diameter; non-effervescent; slightly acid (pH 6.4); gradual wavy boundary.

IIIC2–53 to 64 inches; light yellowish brown (10YR 6/4) very gravelly loamy sand, dark yellowish brown (10YR 4/4) moist; massive; soft, very friable; non-sticky and non-plastic; few fine, very fine and medium roots; 40 percent gravel by volume of ash material mostly less than 3/4 inch in diameter; non-effervescent; slightly acid (pH 6.5).

IVC3–64 to 88 inches; light yellowish brown (10YR 6/4) very gravelly sand, dark yellowish brown (10YR 4/4) moist; massive; soft, very friable, non-sticky and non-plastic; 50 percent gravel by volume of ash material mostly less than 3/4 inches in diameter; few fine and very fine roots; non-effervescent; neutral (pH 6.7).

VC4 sim. 88+ inches.

Reference Pedon Location: Modoc County, California, about 2200 feet east and 500 feet south of the northeast corner of Section 22, T.44N., R.5E.

Range in Characteristics: Depth to a lithic contact of fractured basalt is greater than 40 inches. The mean annual soil temperature at a depth of 20 inches is about 47 to 52°F. and fluctuates by more than 9°F. during the year. The soil temperature at 20 inches exceeds 41°F. from April 15 through November 30 and exceeds 47°F. from May 1 through November 1 in most years. The soil in the moisture control section is usually moist in all parts from December 1 through May 15 and dry in all parts from July 15 through October 30. The control section averages 35 to 95 percent 2-25 mm. gravel size pumice and/or cinders by volume. The bulk density of

the soil fine earth fraction is estimated to be less than 0.95 at 1/3 bar water tension and the ratio of measured clay to 15 bar water is less than 1.25 in all parts of the soil. It is estimated that more than 60 percent of the whole soil by weight is volcanic ash, cinders and/or pumice throughout the soil.

There are three Alcot family soil phases recognized in this survey. They consist of Alcot family pumice phase; Alcot family pumice overburden phase; and Alcot family without pumice.

The Alcot family, pumice phase consists of a geologically recent pumice deposition of 40 to over 60 inches in depth. This pumice material is over a loamy textured cindery material or is directly over basalt flow rock. The A horizon is 2 to 6 inches thick and ranges in colors from 10YR 5/4, 5/3, 5/2, or 4/2 dry, over 10YR 3/4, 3/3, 3/2, or 2/2 moist. It is loamy sand or sand with 35 to 60 percent pumice gravel. The C horizon has colors of 10YR 8/3, 7/2, 6/3, or 6/2 dry, and 10YR 7/3, 6/3, 6/2, 5/3, 5/2, 4/3 moist. Texture in the pumice C material is coarse sand and contains from 70 to 95 percent pumice gravel mainly of the less than 3/4 inch size. A IIC horizon may be present below the pumice material with textures of very gravelly coarse sandy loam or very gravelly sandy loam.

The Alcot family, pumice overburden phase consists of a geologically recent pumice deposition 10 to 40 inches in depth over a loamy textured cindery material below this pumice overburden. The pumice overburden consists of an A horizon 4 to 8 inches in depth and is coarse loamy sand with 15 to 35 percent gravel mainly of the less than 0.4 inch size. Colors are 10YR 5/4, 5/3, 5/2 dry, and 10YR 4/3, 4/2, 3/3 or 3/2 moist. The C horizon is extremely coarse sand with 60 to 90 percent gravel mainly of the 0.2 to 1.0 inch size. Colors are 10YR 8/3, 7/3, or 7/2 dry, and 10YR 7.3 or 6/3 moist. The burried IIAb horizon below the pumice mantle is 2 to 6 inches thick and is sandy loam in texture with 35 to 50 percent gravel mainly of the less than 0.6 inch size. Color is 10YR 6/4 or 5/4 dry, 10YR 4/4 or 3/4 moist. The IIC horizon is sandy loam, and grade to a loamy sand or sand with depth. Gravel content ranges from 35 to 60 percent and is mainly less than 3/4 inch in size and consist of older weathered pumice and cinder material. Colors are 10YR 7/4, 6/6, 6/4, 6/3 dry, and 10YR 4/6, 4/4, 5/4, 5/6 moist.

The Alcot family without the recent pumice deposition has an A horizon 3 to 9 inches in depth. Texture is sandy loam. Gravel content is 20 to 50 percent by volume and mainly of the less than 0.4 inch size. Colors are 10YR 5/4, 5/3, 4/3, 4/2 dry, and 10YR 3/4, 3/3, 3/2 or 2/2 moist. The C horizon has texture of sandy loam or coarse sandy loam and grades to loamy coarse sand and coarse sand with depth. Gravel content is 40 to 85 percent by volume and mainly of the less than 1 inch size. The gravels consist of older weathering cinders and pumice. Color is 10YR 6/3, 6/4, 6/6, 5/4, 5/6 dry and 10YR 3/4, 3/6, 4/4, 4/6, 5/4; 7.5YR 3/4, 4/4, 4/6 moist.

ALICEL FAMILY

The Alicel family consists of moderately deep to deep well drained soils formed in alluvium and aeolian deposits derived mainly from basalt and andesite. Permeability is moderate. These soils are found on rolling foothills with slopes of 5 to 25 percent and occur at elevations of 4200 to 5000 feet. The annual air temperature is 46 to 49°F. The frost free season is 90 to 110 days. The annual precipitation ranges from 10 to 14 inches most of which falls during the winter as snow.

Taxonomic Class: Fine-loamy, mixed, mesic, Pachic Haploxerolls.

Reference Pedon: Alicel family gravelly loam on a southeast facing 12 percent sideslope of a rolling foothill at 4700 feet elevation under big sagebrush and rabbitbrush rangeland with various bunch grasses. Soil was dry when described on 8/16/79. (Colors are for dry soil unless otherwise noted.)

A11–0 to 4 inches; brown (10YR 5/3) gravelly loam, very dark grayish brown (10YR 3/2) moist; weak fine platy structure which parts into weak fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; 20 percent gravel by volume; slightly acid (pH 6.4); clear, smooth boundary.

A12–4 to 9 inches; brown (10YR 5/3) gravelly loam, very dark grayish brown (10YR 3/2) moist; weak to moderate fine granular structure; slightly hard, friable, slightly sticky and non-plastic; 15 percent gravel by volume; common very fine and fine roots, few very fine and fine pores; neutral (pH 6.8); clear, smooth boundary.

A13–9 to 17 inches; brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; massive; slightly hard, friable, non-sticky and slightly plastic; few thin clay films on ped faces; 10 percent gravel by volume; few very fine and fine roots; few very fine and fine pores; neutral (pH 6.8); clear, smooth boundary.

A14–17 to 38 inches; brown (7.5YR 5/4) loam, dark brown (10YR 3/3) moist; massive; slightly hard, friable; non-sticky and slightly plastic; few thin clay films on ped faces; 10 percent gravel by volume; few very fine and fine roots; few very fine and fine pores; neutral (pH 7.0); clear, smooth boundary.

IIC1–38 to 45 inches; light yellowish brown (10YR 6/4) gravelly fine sandy loam, dark yellowish brown (10YR 4/4) moist; massive; hard, friable, non-sticky and non-plastic; 15 percent gravel by volume; neutral (pH 7.0).

R–45 plus inches; hard fractured basalt.

Reference Pedon Location: Modoc County, California, about 100 feet north of road and 1050 feet west and 400 feet north of the SE corner of Section 24, T.46N., R.6E.

Range in Characteristics: Depth to a lithic contact of fractured basalt is greater than 30 inches. The mean annual soil temperature at a depth of 20 inches is about 48 to 52°F. and fluctuates by more than 9°F. during the year. The soil temperature at 20 inches exceeds 41°F. from April 1 through December 1 of most years. The soils 4 to 12 inch moisture control section is usually moist in all parts from December 15 through May 1 and dry in all parts from June 15 through November 15. The average coarse fragment content in the 10 to 40 inch control section is 10 to 35 percent by volume, and also averages 18 to 24 percent in clay content.

The A horizon is 20 to more than 40 inches thick and may make up the whole soil with dry color of 10YR 5/4, 5/3, 5/2 and moist color of 10YR 2/2, 3/2, 3/3, or 7.5YR 3/2. Texture is loam or sandy loam and contains from 10 to 30 percent by volume gravel. Structure is massive or granular and soil pH is slightly acid to neutral.

The B horizon, if present, has dry color of 10YR 6/3, 5/4 or 7.5YR 5/4 and moist color of 10YR 3/4, 4/3 or 7.5YR 3/4 or 4/4. Texture is loam or sandy loam with 15 to 35 percent by volume gravel. Structure is weak to moderate subangular blocky and soil pH is neutral.

The C horizon may or may not be present. If present, it is fine sandy loam or sandy loam with 20 to 40 percent by volume coarse fragments. Dry color is 10YR 6/3, 6/4 and moist color is 10YR 4/4, 4/3 or 7.5YR 4/4. It is massive and soil pH is neutral.

ANATONE FAMILY

The Anatone family consists of shallow, well drained soils that formed in material weathered from hard volcanic tuff, andesite, basalt or obsidian. Permeability is moderate. They are found on mountain sideslopes, ridges, and knolls with slopes of 5 to 90 percent and occur at elevations of 5500 to 7500 feet. The annual precipitation is 20 to 30 inches, most of which falls during the winter as snow. The mean annual air temperature is 40 to 46°F. The frost free season is 60 to 90 days.

Taxonomic Class: Loamy-skeletal, mixed, frigid, Lithic Haploxerolls

Reference Pedon: Anatone family cobbly loam on a west facing 23 percent sideslope at 6520 feet elevation under big sagebrush, mule ears, arrowleaf balsam root and Idaho fescue rangeland with scattered montaine shrubs. Soil was dry when described on 11/4/81. (Colors are for dry soil unless otherwise noted.)

A11–0 to 8 inches; brown (7.5YR 4/2) cobbly loam, very dark brown (7.5YR 2/2) moist; moderate fine and medium granular structure; slightly hard, very friable, slightly sticky and slightly plastic; 10 percent cobbles and 10 percent gravel by volume; many very fine, fine and medium, and few coarse roots; neutral (pH 7.0); gradual wavy boundary.

A12–8 to 17 inches; brown (7.5YR 4/2) very cobbly loam, dark brown (7.5YR 3/2) moist; moderate fine and medium subangular blocky structure which parts into moderate fine and medium granular; slightly hard, very friable, slightly sticky and slightly plastic; 25 percent cobbles and 30 percent gravel by volume; common to many very fine and fine, common medium, and few coarse roots; neutral (pH 6.8); abrupt wavy boundary.

R–17 plus inches; hard fractured vasicular basalt.

Reference Pedon Location: Lassen County, California, about 750 feet west and 1400 feet south of the northeast corner of Section 10, T.38N., R.11E.

Range in Characteristics: Depth to a lithic contact of fractured basalt, andesite, obsidian, or volcanic tuff is 8 to 20 inches. The mean annual soil temperature at the lithic contact is about 41 to 47°F. and fluctuates by more than 9°F. during the year. The soil temperature at the contact exceeds 41°F. from May 15 through November 15 and exceeds 47°F. from June 15 through October 15 in most years. The soils 5 to 15 inch moisture control section, or to the lithic contact if shallower, is usually moist in all parts from November 20 through May 15, and dry in all parts from July 20 through October 20. The average rock fragment content of the control section is 35 to 70 percent by volume, and also averages 16 to 24 percent clay.

The A horizon normally occupies the whole soil depth and have dry color of 7.5YR 4/2, 4/3; 10YR 4/3, 5/3, 5/4 and moist color of 7.5YR 2/2, 3/2; 10YR 2/1, 2/2, 3/2 or 3/3. Texture is loam or sandy loam and contains from 35 to 70 percent by volume rock fragments consisting mainly of gravel, cobbles and stones. Structure is granular and subangular blocky and soil pH is slightly acid to neutral.

AQUOLLS

Aquolls consist of moderately deep to very deep, poorly drained soils that formed in alluvium from mixed rock sources. Permeability is moderately slow to very slow. They are in drainageways on 0 to 5 percent slopes and are subject to flooding. Elevation ranges from 4400 to 6400 feet and annual precipitation ranges from 14 to 25 inches most of which falls during the winter as snow. The mean annual air temperature is 44 to 49°F. The frost free season is 60 to 110 days.

Taxonomic Class: Aquolls

Reference Pedon: NOTE: The following pedon description is not necessarily intended to be the modal concept, but only as a reference pedon. Aquoll silty clay loam on a nearly level drainageway at 5300 feet elevation under sedges, poa sp., and other grasses. Soil was moist throughout and saturated below 26 inches when described on 6/22/78. (Colors are for dry soil unless otherwise stated.)

A1–0 to 4 inches; dark grayish brown (10YR 4/2) silty clay loam, black (10YR 2/1) moist; strong fine granular structure; hard, friable, sticky and plastic; many fine, very fine and common medium roots; neutral (pH 6.6); abrupt smooth boundary.

B2t–4 to 17 inches; dark grayish brown (10YR 4/2) clay, very dark brown (10YR 2/2) moist strong medium prismatic structure parting to strong medium angular blocky; very hard, very firm, very sticky and very plastic; many fine, very fine and few medium roots; common to many very fine and fine pores; many distinct clay films on ped faces and pores; neutral (pH 6.8); clear smooth boundary.

B3tg–17 to 26 inches; grayish brown (2.5YR 5/2) clay, dark grayish brown, (2.5YR 4/2) moist; 20 percent prominent medium yellowish brown (10YR 5/6) mottles; moderate coarse prismatic structure which parts to moderate fine and medium angular blocks; very hard, very firm, very sticky and very plastic; many very fine and common fine roots; few to common fine and very fine pores; many distinct clay films on ped faces and pores; neutral (pH 7.0); clear wavy boundary.

C1g–26 to 33 inches; gray (5Y 5/1) clay, dark gray (5Y 4/1) moist; 50 percent distinct medium yellowish brown (10YR 5/8) mottles; massive; very hard, firm, very sticky and very plastic; few fine and common very fine roots; neutral (pH 6.6); abrupt smooth boundary.

IIC2g–33 to 60 inches; dark gray (5Y 4/1) 2 to 6 inch stratified lenses of very gravelly clay, clay and very gravelly clay loam, dark grayish brown (2.5Y 4/2) moist; 50 to 60 percent distinct medium yellowish brown (10YR 5/8) mottles; massive; hard, firm, very sticky and plastic; few fine and very fine roots; slightly acid (pH 6.4).

Reference Pedon Location: Modoc County, California, about 600 feet west and 1100 feet south of the NE corner of Section 18, T.40N., R.6E.

Range in Characteristics: Depth to bedrock is greater than 20 inches. fluctuating apparent water table exists within 10 to 40 inches of the surface with a capillary fringe at or near the surface. These soils are normally saturated with water during most of the year except where artifically drained. The soil temperature at the 20 inch depth is above 41°F. from about May 1 through November 30 in most years and the mean annual soil temperature at that depth is about 47 to 52°F. Clay content in the control section averages 30 to 70 percent and coarse fragments average 0 to 45 percent by volume.

The A horizon is 2 to 16 inches thick with dry color of 10YR 3/1, 4/1, 4/2, 4/3, 5/2, 5/3; 2.5Y 4/2, 3/2 and moist color of 10YR 2/1, 2/2, 3/1, 3/2; 2.5Y 3/2. Texture is loam, silt loam, clay loam, silty clay loam or clay and contains from 0 to 40 percent by volume coarse fragments. Structure is platy, granular or subangular blocky and soil pH is slightly acid to mildly alkaline.

The B horizon has dry color of 10YR 4/1, 4/2, 4/3, 4/4, 5/1, 5/2, 5/3, 5/3; 2.5Y 4/2, 4/4, 5/2 and moist color of 10YR 2/1, 2/2, 3/1, 3/2, 3/3, 3/4,4/2, 4/3; 7.5YR 3/2; 2.5Y 3/2, 4/2. The upper 7 inches of soil has mollic colors and may include the whole B horizon. Texture is clay loam, silty clay loam, sandy clay loam, silty clay or clay and contains from 0 to 60 percent by volume coarse fragments. Structure is prismatic or blocky and soil pH is slightly acid to mildly alkaline.

The C horizon has dry color of 10YR 5/1, 5/2, 6/2; 2.5Y 5/2,6/2, 6/4; 5Y 4/1, 5/1, 5/2, 6/2 and moist color of 10YR 4/2, 5/2; 2.5Y 4/2, 5/2; 5Y 4/1, 4/2, 5/1, 5/2. Common to many distinct yellowish brown to yellowish red mottles are evident throughout the C horizon. Texture is loam, clay loam, silty clay loam, silty clay or clay and may contain up to 60 percent by volume coarse fragments. It is massive or is in stratified lenses and soil pH is slightly acid to neutral.

BAKEOVEN FAMILY

The Bakeoven family consists of shallow, well drained soils that formed in material weathered from basalt. Permeability is moderately rapid. These soils are found on basalt plateaus and mountain uplands at elevations of 4200 to 7000 feet. Slopes range from 1 to 70 percent. The annual precipitation is 10 to 20 inches most of which falls during the winter as snow. The mean annual air temperature is 44 to 50°F. The frost free season is 60 to 110 days.

Taxonomic Class: Loamy-skeletal, mixed, mesic, Lithic Haploxerolls.

Reference Pedon: Bakeoven family very cobbly fine sandy loam on a 4 percent north sloping basalt plateau interspersed with lava flow rock at 4500 feet elevation under rabbitbrush and cheatgrass rangeland. Soil was dry when described on 11/6/81. (Colors are for dry soil unless otherwise stated.)

A11–0 to 5 inches; dark grayish brown (10YR 4/2) very cobbly fine sandy loam, very dark brown (10YR 2/2) moist, moderate fine and medium subangular blocky structure which parts into fine and medium granular structure; slightly hard, very friable, slightly sticky and non-plastic; 30 to 40 percent cobbles, and 5 to 10 percent gravel by volume; many very fine and fine, common medium roots; few to common very fine and fine pores; neutral (pH 6.6); clear smooth boundary.

A12–5 to 11 inches; grayish brown (10YR 5/2) very cobbly fine sandy loam, very dark brown (10YR 2/2) moist; weak to moderate fine and medium subangular blocky structure which parts into moderate fine and medium granular; slightly hard, very friable, slightly sticky and non-plastic; 45 percent cobbles and 5 to 10 percent gravel by volume; common very fine, fine and medium roots; few to common very fine and fine pores; neutral (pH 6.6) abrupt wavy boundary.

R–11 plus inches; hard vesicular basalt, irregularly fractured.

Reference Pedon Location: Siskiyou County, California, about 1800 feet west and 700 feet south of the NE corner of Section 7, T.45N., R.4E.

Range in Characteristics: Depth to the lithic contact ranges from 7 to 20 inches. The mean annual soil temperature at the lithic contact is about 47 to 53°F. and fluctuates by more than 9°F. during the year. The soil temperature at the lithic contact exceeds 41°F. from April 1 through December 1. Where this soil is mapped in map units 118, 119, 120, 121, 122, 139, 239, and 276 the soil between depths of about 5 to 15 inches, or lithic contact if shallower, is usually dry in all parts from June 15 through November 15, and moist in all parts from December 15 through May 1. Where this soil is mapped in map unit 240 the soil at the 5 to 15 inch depth, or lithic contact if shallower, is usually dry in all parts from July 1 through October 30, and moist in all parts from December 1 through May 1. The average rock fragment content of the control section is 35 to 75 percent by volume and clay content averages 10 to 24 percent.

The A horizon normally occupies the whole soil depth and have dry color of 10YR 4/2, 5/2, 5/3, 5/4 and moist color of 10YR 2/2, 3/2, or 3/3. A thin 1 to 8 inch pumice ash and gravel overburden is present in some pedons. Texture is loam, sandy loam, fine sandy loam, or coarse sandy loam and contains from 35 to 75 percent by volume rock fragments consisting mainly of gravels, cobbles and stones. Structure is granular to subangular blocky and soil pH is neutral.

BARNARD FAMILY

The Barnard family consists of moderately deep, well drained soils that formed in material weathered from basalt and tuff. Permeability is slow. These soils are on basalt plateaus on 0 to 20 percent slopes and occur at elevations of 4300 to 6000 feet. The climate is cool. The annual precipitation is 10 to 16 inches, most of which falls during the winter as snow. The mean annual air temperature is 44 to 49°F. and the frost free season is 80 to 110 days.

Taxonomic Class: Fine, montmorillonitic, mesic, Aridic Durixerolls.

Reference Pedon: Barnard family cobbly loam on an east facing 16 percent basalt plateau sideslope at 5140 feet elevation under western juniper, big sagebrush, rabbitbrush and bluegrass rangeland. Soil was dry when described on 9/15/75. (Colors are for dry soil unless otherwise noted.)

A1–0 to 3 inches; grayish brown (10YR 5/2) cobbly loam, very dark grayish brown (10YR 3/2) moist; moderate coarse and very coarse platy structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine and fine interstitial pores, few very fine tubular pores; 30 percent by volume mixed cobbles and gravel; slightly acid (pH 6.5); gradual smooth boundary.

A3–3 to 8 inches; dark grayish brown (10YR 4/2) gravelly light clay loam, very dark grayish brown (10YR 3/2) moist; moderate coarse and very coarse subangular blocky structure; slightly hard, very friable, slightly sticky and plastic; common very fine and fine roots; common very fine and fine tubular pores; 30 percent by volume mixed gravel; neutral (pH 7.0); clear smooth boundary.

B21t–8 to 17 inches; dark brown (7.5YR 4/2) clay, dark brown (7.5YR 3/2) moist; strong fine subangular blocky structure; hard, firm, sticky and plastic; common fine, and few medium roots; common very fine and fine tubular pores; common pressure faces on ped faces, few moderately thick clay films on face of peds, and clay bridges between mineral grains; 10 to 15 percent by volume mixed gravel; neutral (pH 7.0); gradual wavy boundary.

B22t–17 to 32 inches; brown (7.5YR 5/4) gravelly silty clay, dark brown (7.5YR 3/4) moist; strong very fine and fine subangular blocky structure; hard, firm, sticky and plastic; few fine and medium roots; few very fine tubular pores; many moderately thick clay films on face of peds, and clay bridges between mineral grains; many pressure faces in lower 3 inches; 20 percent by volume mixed gravel, 10 percent cobbles; mildly alkaline (pH 7.5); abrupt wavy boundary.

Csim–32 to 42 inches; very pale brown (10YR 7/4) silica duripan, dark yellowish brown (10YR 4/4) moist; strong fine and medium platy structure; weakly to strongly cemented; moderately alkaline (pH 8.0).

R–42 plus inches; slightly weathered hard basalt.

Reference Pedon Location: Modoc County, California, about 50 feet east of dirt road to cinder pit just past major curve in road and about 250 feet north and 1650 feet west of the southeast corner of Section 14, T.39N., R.14E.

Range in Characteristics: Depth to silica duripan ranges from 20 to 40 inches and is generally underlain by hard fractured basalt or tuff. The silica duripan normally ranges in thickness from 5 to 20 inches. The mean annual soil temperature is 20 inches is about 47°F. to 52°F. and fluctuates by more than 9°F. during the year. The soil temperature at 20 inches exceeds 41°F. from April 1 through December 1 in most years. The 4 to 12 inch moisture control section is usually dry in all parts from June 15 through November 15 and moist in all parts from December 15 through May 1. The average coarse fragment content of the control section is 5 to 30 percent by volume, and clay content averages 35 to 50 percent.

The A horizon is 4 to 8 inches thick with dry colors of 10YR 4/2, 5/2, 5/3 and moist colors of 10YR 3/1, 3/2, 3/3 or 7.5YR 3/2. Texture is loam or clay loam and normally contain between 5 to 40 percent gravel and cobbles. It has platy granular or subangular blocky structure and soil pH is slightly acid to neutral.

The B horizon has dry colors of 10YR 4/2, 4/3, 5/4, 6/4 or 7.5YR 4/2, 4/4, or 5/4 and moist colors of 10YR 3/2, 3/3, 3/4, 4/2, 4/3 or 7.5YR 3/2, 3/4, 4/4. The upper part of the argillic B horizon normally has the darker mollic colors. Texture is clay loam, silty clay or clay and normally contain between 5 and 30 percent by volume coarse fragments. Structure is blocky and soil pH is neutral to mildly alkaline.

The C horizon normally consists entirely of the silica duripan which is weakly to strongly cemented.

BEARSKIN FAMILY

The Bearskin family consists of shallow, well drained soils that formed from hard volcanic tuff or basalt. Permeability is moderately slow. These soils are on mountain sideslopes of 2 to 60 percent. Elevation ranges from 5500 to 7000 feet. The annual precipitation is 20 to 25 inches, most of which falls during the winter as snow. Mean annual air temperature is 42 to 46°F. The frost free season is 60-90 days.

Taxonomic Class: Loamy, mixed, frigid, Lithic Agrixerolls.

Reference Pedon: Bearskin family cobbly loam on a south facing 15 percent slope at 5700 feet elevation under low sagebrush, western juniper, bottlebrush and wheatgrass rangeland. Soil was dry when described on 8/23/79. (Colors are for dry soil unless otherwise noted.)

A11–0 to 4 inches; brown (10YR 5/3) cobbly loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium platy structure which parts into moderate very fine and fine granular; soft, very friable, slightly sticky and slightly plastic; 30 percent gravel and cobbles by volume; many very fine and fine, few medium and coarse roots; neutral (pH 6.8); clear smooth boundary.

A12–4 to 8 inches; brown (10YR 4/3) cobbly loam, very dark grayish brown (10YR 3/2) moist; weak to moderate fine and medium platy structure which parts into moderate to strong very fine or fine subangular blocks; slightly hard, friable, slightly sticky and slightly plastic; few thin clay films on ped faces; 30 percent basalt gravel and cobbles by volume; many very fine and fine, few medium roots; neutral (pH 6.8); clear wavy boundary.

B21t–8 to 14 inches; brown (10YR 4/3) cobbly silty clay loam, dark brown (10YR 3/3) moist; moderate fine and medium subangular and angular blocky structure which parts into moderate to strong medium and coarse granular; slightly hard, friable, sticky and plastic; few moderately thick clay films on ped faces; 20 percent basalt gravel and cobbles by volume; common very fine, fine, medium and coarse roots; many very fine and fine, few medium; neutral (pH 6.6); clear wavy boundary.

B22t–14 to 18 inches; dark yellowish brown (10YR 4/4) cobbly silty clay loam, dark brown (7.5YR 3/2) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, sticky and plastic; common moderately thick clay films on ped faces; 30 to 35 percent tuff gravel and cobbles by volume; common very fine, fine, medium and coarse roots; neutral (pH 6.6); clear wavy boundary.

R–18 inches; hard congolmerated volcanic tuff.

Reference Pedon Location: Modoc County, California, about 30 feet above the road and about 1400 feet east and 1850 feet south of the northwest corner of Section 24, T.40N., R.14E.

Range in Characteristics: Depth to hard conglomerated tuff, or basalt is 10 to 20 inches. The control section averages 24 to 35 percent clay and coarse fragments average 10 to 35 percent by volume. The mean annual soil temperature at the lithic contact is about 43 to 47°F. and fluctuates by more than 9°F. during the year. The soil temperature at the contact exceeds 41°F. from June 15 through October 15 in most years. The soils 4 to 12 inch moisture control section, or to the lithic contact is shallower, is usually moist in all parts from November 20 through May 15, and dry in all parts from July 20 through October 20.

The A horizon is 4 to 8 inches thick with dry colors of 10YR 4/2, 4/3, 5/2, 5/3 or 7.5YR 4/2 or 4/4 and moist colors of 10YR 2/2, 3/2, 3/3 or 7.5YR 3/2. Texture is loam or light clay loam with normally 15 to 35 percent by volume coarse fragments. Structure is granular, platy or blocky and soil pH is neutral.

The B horizon makes up the remainder of the soil with dry colors of 10YR 4/3, 4/4, 5/3, 5/4 or 7.5YR 4/4, 5/2 or 5/4 and moist colors of 10YR 3/2, 3/3 or 7.5YR 3/2. Texture is clay loam or silty clay loam with 10 to 35 percent by volume rock fragments. Structure is blocky or prismatic and soil pH is neutral to slightly acid.

BEHANIN FAMILY

The Behanin family consists of moderately deep and deep well drained soils that formed in material weathered from andesite, basalt, or conglomerated tuff. Permeability is moderate. These soils are found on mountain sideslopes. The slopes ranges from 5 to 55 percent and elevations range from 7000 to 9700 feet. The annual precipitation is 25 to 35 inches which falls mainly as snow during the winter and the mean annual air temperature is 34 to 40°F. The frost free season is less than 30 days to 70 days.

Taxonomic Class: Loamy-skeletal, mixed, Pachic Cryoborolls.

Reference Pedon: Behanin family very gravelly loam on a northwest facing 29 percent mountain sideslope at 7100 feet elevation under a white fir forest with a sparse understory of snowberry, lupine and bottlebrush. Soil was moist below 17 inches when described on 9/13/80. (Colors are for dry soil unless otherwise stated.)

01–1-1/2 to 0 inches; white fir needles and twigs.

A11–0 to 7 inches; very dark grayish brown (10YR 3/2) very gravelly loam, black (10YR 2/1) moist; weak medium subangular blocky structure which parts to weak to moderate fine and medium granular; slightly hard, very friable, slightly sticky and slightly plastic; 5 percent stones, 10 percent cobbles and 25 percent gravel by volume; many very fine, fine and medium and common coarse roots; few to common very fine and fine pores; medium acid (pH 6.0); gradual wavy boundary.

A12–7 to 17 inches; very dark grayish brown (10YR 3/2) very stony loam, black (10YR 2/1) moist; weak to moderate medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; 20 percent stones, 15 percent cobbles and 15 percent gravel by volume; many very fine, fine and medium and common coarse roots; common very fine and fine pores; slightly acid (pH 6.2); gradual wavy boundary.

A13–17 to 34 inches; dark brown (10YR 3/3) very stony loam, very dark brown (10YR 2/2) moist; weak fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; 20 percent stones, 20 percent cobbles, and 15 percent gravel by volume; many very fine and fine, common medium and coarse roots; few very fine and fine pores; slightly acid (pH 6.2); gradual wavy boundary.

IIA14–34 to 60 plus inches; brown (10YR 4/3) extremely gravelly loam, very dark grayish brown (10YR 3/2) moist; moderate fine subangular blocky structure; slightly hard, friable, sticky and slightly plastic; 60 percent weathered basalt gravel by volume; common very fine, fine and medium and few coarse roots; few very fine and fine pores; slightly acid (pH 6.4).

Reference Pedon Location: Modoc County, California, about 50 feet east of road and 2100 feet west and 250 feet south of the northeast corner of Section 13, T.44N., R.14E.

Range in Characteristics: Depth to a lithic contact ranges from 20 to 40 inches in map units 123 and 124 to greater than 40 inches in map units 125, 126, 170 and 275. The mean annual soil temperature at the 20 inch depth is about 36 to 42°F. The soil temperature at the 20 inch depth exceeds 41°F. from July 1 through October 30 and exceeds 47°F. from July 20 through September 20 in most years. The mean summer soil temperature at 20 inches is less than 47°F. The soils 5 to 15 inch moisture control section is usually moist in all parts from November 1 through June 15 and dry in all parts from August 15 through October 10. The rock fragment content of the control section averages 35 to 65 percent by volume and the clay content averages 18 to 24 percent.

The A horizon normally occupies the whole soil depth and have dry color of 10YR 3/2, 3/3, 4/2, 4/3, 5/3, or 5/4 and moist color of 10YR 2/1, 2/2, 3/2, or 3/3. Texture is loam or sandy loam with 30 to 70 percent by volume rock fragments consisting mainly of gravel size with normally lessor amounts of cobbles and stones. Structure is granular and subangular blocky and soil pH is medium acid to neutral.

BERTAG FAMILY

The Bertag family consists of deep and moderately deep, well drained soils weathered from volcanic tuff and basalt. Permeability is slow. These soils are on mountain sideslopes with 10 to 60 percent slopes and elevations of 5500 to 7500 feet. The climate is cool with an annual precipitation of 20 to 30 inches most of which falls in the winter as snow. The mean annual air temperature is 40 to 46°F. and the frost free season is 60 to 90 days.

Taxonomic Class: Fine, montmorillonitic, frigid, Pachic Ultic Argixerolls.

Reference Pedon: Bertag family loam on a west facing 13 percent mountain sideslope at 6550 feet elevation under a predominately white fir forest with a few Jeffrey pine and ponderosa pine and a sparce understory of mountaine shrubs. Soil was moist below 13 inches when described on 8/12/80. (Colors are for dry soil unless otherwise stated.)

0–1-1/2 to 0 inches; litter of white fir and ponderosa pine needles and twigs.

A1–0 to 13 inches; dark brown (10YR 3/3) loam, very dark brown (10YR 2/2) moist; weak fine and medium subangular blocky structure which parts to moderate fine and medium granular; slightly hard, friable, slightly sticky and slightly plastic; 5 to 10 percent gravel and 5 percent by volume basalt cobbles; common very fine and fine pores; slightly acid (pH 6.4) clear smooth boundary.

B1t–13 to 20 inches; dark brown (10YR 4/3) cobbly clay loam, very dark brown (10YR 2/2) moist; moderate fine and medium granular and subangular blocky structure; hard, friable, sticky and plastic; few to common thin clay films on ped faces and interstitial pores; 10 to 15 percent gravel and 10 percent by volume basalt cobbles; common very fine and fine pores; slightly acid (pH 6.4); clear wavy boundary.

B21t–20 to 30 inches; dark brown (7.5YR 4/4) gravelly clay, dark brown (7.5YR 3/2) moist; moderate medium subangular blocky structure; very hard, firm, very sticky and plastic; common moderately thick clay films on ped faces and interstitial pores; 15 to 20 percent by volume basalt gravel; common very fine and fine pores; slightly acid (pH 6.2); gradual wavy boundary.

B22t–30 to 38 inches; brown (7.5YR 5/4) gravelly clay, dark brown (7.5YR 3/2) moist; moderate medium subangular blocky structure; very hard, firm, very sticky and plastic; common moderately thick clay films on ped faces and interstitial pores; 25 percent by volume basalt gravel; common very fine and fine pores; slightly acid (pH 6.4); gradual wavy boundary.

B23t–38 to 60 plus inches; brown (10YR 4/3) gravelly clay, dark brown (10YR 3/3) moist; moderate fine and medium subangular blocky structure; very hard, firm, very sticky and plastic; common moderately thick clay film on ped faces and interstitial pores; 30 to 35 percent by volume basalt gravel; few to common very fine and fine pores; neutral (pH 6.8).

Reference Pedon Location: Modoc County, California, about 50 feet east of road and 2100 feet east and 1550 feet north of the southwest corner of Section 5, T.40N., R.15E.

Range in Characteristics: Depth to a lithic contact is 20 to 40 inches in map unit 128 and greater than 40 inches in map units 127, 129 and 254. The mean annual soil temperature at a depth of 20 inches is 41 to 47°F. and fluctuates by more than 9°F. during the year. The soil temperature at the 20 inch depth exceeds 41°F. from June 15 through October 15 in most years. The soils 4 to 12 inch moisture control section is usually moist in all parts from November 15 through May 30 and dry in all parts from August 1 through October 20. The coarse fragment content of the control section averages 5 to 35 percent by volume and the clay content averages 35 to 50 percent. Base saturation averages 60 to 75 percent in the A horizon and increases with depth.

The A horizon is 8 to 18 inches thick with dry colors of 10YR 3/3, 3/4, 4/3, 4/4, 5/3 or 7.5YR 4/2, or 4/4 and moist colors for 10YR 2/1, 2/2, 3/2, 3/3 or 7.5YR 3/2. Texture is loam or clay loam and normally contain from 5 to 25 percent by volume coarse fragments. Structure is granular or blocky and soil pH is medium acid to neutral.

The B horizon normally occupies the remaining soil depth with dry colors of 10YR 4/2, 4/3, 5/3, 5/4 or 7.5YR 4/2, 4/4 or 5/4 and moist colors 10YR 2/2, 3/2, 3/3, 3/4 or 7.5YR 3/2 or 3/4. The upper parts of the argillic B horizon has mollic colors. Texture is clay loam or clay and ranges from 5 to 35 percent by volume in coarse fragment content. Structure is normally blocky or prismatic and soil pH is medium acid to neutral.

BIEBER FAMILY

The Bieber family consists of shallow, well drained soils that formed mainly over hard fractured basalt or volcanic tuff. Permeability is very slow. These soils have a silica duripan at depths of 7 to 20 inches. They are on basalt plateaus and alluvial fans and toeslopes of mountain uplands with 1 to 20 percent slopes at elevations of 4300 to 6000 feet. Annual precipitation is 12 to 18 inches, most of which falls in winter as snow. Mean annual air temperature is 44 to 49°F. The frost-free season is 80 to 110 days.

Taxonomic Class: Clayey, montmorillonitic, mesic, shallow, Aridic Durixerolls.

Reference Pedon: Bieber family very cobbly loam on a 2 percent south facing undulating basalt plateau at 5000 feet elevation under low sagebrush, scattered western juniper and Idaho fescue, cheatgrass and Sandberg bluegrass rangeland. Soil was moist when described on 4/11/80. (Colors are for dry soil unless otherwise stated.)

A1–0 to 4 inches; brown (10YR 5/3) very cobbly heavy loam; dark brown (10YR 3/3) moist; weak to moderate fine subangular blocky structure parting to moderate fine granular; hard, friable, sticky and plastic; 55 percent by volume cobbles, gravel and stones of basalt on surface; many fine, very fine and few medium and coarse roots; common fine, very fine and few medium tubular pores; neutral (pH 6.8); clear smooth boundary.

B21t–4 to 8 inches; brown (7.5YR 5/4) light clay; dark reddish brown (5YR 3/3) moist; moderate fine subangular blocky structure parting to moderate to strong fine and medium granular; very hard, firm, very sticky and plastic; 5 percent cobbles and gravel of basalt by volume; common to many thin faint clay films on ped faces; common to many very fine, fine and medium and few coarse roots; common very fine and fine tubular pores; neutral (pH 6.8); abrupt smooth boundary.

B22t–8 to 15 inches; brown (7.5YR 4/4) clay; dark brown (7.5YR 3/4) moist; strong medium and coarse prismatic structure parting to strong fine and medium angular blocks; extremely hard, firm, very sticky and very plastic; about 5 percent by volume basalt gravel and cobbles; many faint and distinct clay skins on ped faces and in pores; common very fine, fine, medium and coarse roots; common very fine tubular pores; neutral (pH 6.8) clear smooth boundary.

B3tsi–15 to 18 inches; strong brown (7.5YR 5/6) clay; strong brown (7.5YR 4/6) moist; strong fine and medium angular blocky structure; extremely hard, very firm, very sticky and very plastic; about 10 percent by volume basalt cobbles and gravel; many distinct thick clay skins on ped faces; few fine, very fine, medium and coarse roots; common very fine and few fine tubular pores; common distinct thin masses of silica deposits; neutral (pH 7.0); abrupt smooth boundary.

Csim–18 to 23 inches; medium and coarse platy silica duripan with 1 mm to 5 mm thick laminar plates coated with silica or opal.

R–23 plus inches; hard fractured basalt.

Reference Pedon Location: Modoc County, California, about 400 feet west and 1100 feet south of NE corner Section 22, T.45N., R.11E.

Range in Characteristics: Depth to silica duripan ranges from 7 to 20 inches. The silica duripan is generally only a few millimeters to a feet in thickness and is underlain by basalt or volcanic tuff. The control section averages 35 to 60 percent clay. The mean annual soil temperature at the contact is about 47 to 52°F. and fluctuates by more than 9°F. during the year. The soil temperature at the duripan contact exceeds 41°F. from April 1 through December 1. The 4 to 12 inch moisture control section, or to the duripan contact if shallower, is usually dry in all parts from June 15 through November 15, and moist in all parts from December 15 through May 1.

The A horizon is 2 to 6 inches thick with dry color of 10YR 4/2, 4/3, 5/2, 5/3, 5/4 or 7.5YR 4/2, 5/2 and moist color of 10YR 2/2, 3/2, 3/3 or 7.5YR 3/2. Texture is loam or clay loam and normally contain between 20 to 80 percent surface basalt rock fragments of cobbles, gravel and stones. Structure is granular or blocky and soil pH is neutral.

The B horizon has dry color of 10YR 4/3, 4/4, 5/3, 5/4, 6/3, 6/4; 7.5YR 4/4, 5/4, 5/6, 6/4 and moist colors of 10YR 3/2, 3/3, 3/4, 4/3; 7.5YR 3/2, 3/4, 4/4, 4/6; 5YR 3/2 or 3/3. The upper part of the agrillic B horizon has mollic colors. Texture is clay loam or clay. Structure is blocky or prismatic and soil pH is neutral.

The Csim horizon is platy or massive and strongly cemented or indurated and may have opal coated laminar plates cemented in a mosaic.

CARDON FAMILY

The Cardon family consists of deep, somewhat poorly drained soils formed in clayey alluvium derived from basalt, andesite or tuff. This soil is found on flood plains and alluvial basins and drainages and on lower sideslopes of mountain uplands and basalt plateaus. Permeability is very slow. The slopes are generally nearly level but range from 0 to 15 percent. Elevations range from 4600 to 6200 feet. The annual precipitation is 14 to 20 inches which falls mostly during the winter as snow and the mean annual air temperature is 44 to 49°F. The frost free season is 80 to 110 days.

Taxonomic Class: Fine, montmorillonitic, mesic, Chromic Pelloxererts.

Reference Pedon: Cardon family clay on a 6 percent west sloping alluvial drainageway at 6000 feet elevation under mosses, timothy, Kentucky blue grass and other meadow grasses. Soil was dry to 36 inches when described on 9/10/80. (Colors are for dry soil unless otherwise noted.)

A1–0 to 4 inches; very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; weak to moderate fine and medium platy structure which parts into moderate fine angular and subangular blocky; hard, very firm, sticky and plastic; less than 5 percent gravel by volume; many very fine, fine and medium roots; cracks are 2-1/2 inches wide and 10 to 24 inches between cracks; neutral (pH 6.8); clear smooth boundary.

C1–4 to 10 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; strong medium angular blocky structure and strong medium and coarse prismatic; extremely hard, very firm, very sticky and very plastic; slicken sides on ped faces; less than 5 percent gravel by volume; common to many very fine and fine, common medium roots; cracks 2 inches wide; neutral (pH 6.8); gradual wavy boundary.

C2–10 to 36 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; strong medium and coarse prismatic and angular blocky structure; extemely hard, very firm, very sticky and very plastic; slickensides on ped faces; less than 1 percent gravel by volume; few to common very fine, fine and few medium roots; cracks 0.4 to 1.2 inches wide; neutral (pH 6.8); clear smooth boundary.

C3g–36 to 46 inches; grayish brown (2.5Y 5/2) 1 to 3 inch stratified lenses of clay and clay loam with many medium and coarse distinct olive yellow (2.5Y 6/6) mottles, dark grayish brown (2.5Y 4/2) moist; massive; hard, firm, very sticky and plastic; 5 percent gravel by volume; few very fine roots; neutral (pH 7.0); gradual wavy boundary.

C4g–46 to 60 inches; light brownish gray (2.5Y 6/2) clay, light brownish gray (2.5Y 6/2) moist, with many medium and coarse distinct olive yellow (2.5Y 6/6) mottles; massive; extremely hard, very firm, very sticky and very plastic; less than 1 percent gravel by volume; neutral (pH 7.2).

Reference Pedon Location: Modoc County, California, about 2200 feet east and 2000 feet south of the NW corner Section 36, T.42N., R.14E.

Range in Characteristics: Depth to bedrock is greater than 40 inches. Clay content in the control section ranges from 45 to 60 percent. The Cardon soils have surface cracks of 1 to 3 inches wide and extend to depths of greater than 20 inches which open and close at least once each year and remain open during the period of July 15 through October 15 and remain closed for the rest of the year. Intersecting slickensides or pressure faces are common between the 4 and 36 inch depth. The annual soil temperature at the 20 inch depth is estimated to range between 47 to 53°F. The soil between depths of 4 to 12 inches is usually dry in all parts from July 15 through October 15 and is moist in some or all parts all the rest of the year.

The A horizon is 1 to 5 inches thick and has dry color of 10YR 3/1, 4/1, 5/1, and moist color of 10YR 2/1 or 2/1. Texture is silty clay or clay. Structure is platy or blocky and soil pH is neutral.

The C horizon has dry color of 10YR 4/1, 4/2, 5/1, 6/2, 6/3; 2.5Y 5/2, 5/4, 6/2 and moist color of 10YR 3/1, 4/1, 4/2; 2.5Y 4/2, 5/2, 6/2. Dry and moist chromes of 2, 3 or 4 occur within 1 meter of the surface. Texture is silty clay or clay and often grade to clay loam with depth or is encountered in stratified lenses below about 30 to 40 inches.

CASTLEVALE FAMILY

The Castlevale family consists of shallow, well drained soils that have weathered from basalt. The top layer of soil generally consists of 50 to 100 percent pumice materials. Permeability is moderate. These soils are found generally on basalt plateaus with slopes of 1 to 10 percent. The elevation is 4200 to 4600 feet. The annual precipitation is 10 to 14 inches most of which falls during winter as snow. The mean annual air temperature is 48 to 50°F. The frost free season is 90 to 110 days.

Taxonomic Class: Loamy, mixed, mesic, Lithic Xerollic Haplargids.

Reference Pedon: Castlevale family very gravelly coarse sandy loam on a nearly level basalt plateau at 4200 feet elevation under big sagebrush, rabbitbrush and bunchgrass rangeland. Soil was dry when described on 8/14/78. (Colors are for dry soil unless otherwise stated).

A1–0 to 4 inches; grayish brown (10YR 5/2) very gravelly coarse sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium granular structure; soft, very friable, non-sticky and non-plastic; 55 percent pumice gravel by volume; many fine and very fine roots; neutral (pH 6.6); clear smooth boundary.

C1–4 to 8 inches; pale brown (10YR 6/3) extremely gravelly coarse sandy loam, brown (10YR 5/3) moist; weak medium granular structure; soft, very friable, non-sticky and non-plastic; 60 percent pumice gravel by volume; common to many fine and very fine roots; neutral (pH 6.8); clear smooth boundary.

IIA1b–8 to 13 inches; yellowish brown (10YR 5/4) gravelly sandy loam, dark yellowish brown (10YR 3/4) moist; weak fine and medium subangular blocky structure; soft, very friable, non-sticky and non-plastic; 30 percent basalt gravel by volume; few to common fine and very fine roots; neutral (pH 6.8); clear wavy boundary.

IIB2tb–13 to 18 inches; light yellowish brown (10YR 6/4) gravelly loam, dark yellowish brown (10YR 4/4) moist; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few thin clay films on ped faces; gravel 25-30 percent basalt by volume; few and common fine and very fine roots; neutral (pH 7.0); clear smooth boundary.

R–18 inches; fractured hard basalt.

Reference Pedon Location: Modoc County, California, about 2600 feet east and 800 feet south of NW corner of Section 1, T.44N., R.5E.

Range in Characteristics: Depth to bedrock is 8 to 20 inches. Clay content increases with depth and the control section averages 22 to 28 percent clay. Coarse fragments range from 10 to 35 percent by volume in the control section. The mean annual soil temperature at the lithic contact is about 50 to 52°F. and fluctuates by more than 9°F. during the year. The soil temperature at the contact exceeds 41°F. from April 1 through December 1. The soils 4 to 12 inch moisture control section, or to the lithic contact if shallower, is usually dry in all parts from June 15 through November 15, and moist in all parts from December 15 through May 1.

The pumice overburden consists of an approximate 900 year old pumice deposit of 2 to 12 inches and normally has an A and sometimes an A-C horizon development in the deeper deposits. The A horizon is 2 to 8 inches thick and has dry color of 10YR 5/2, 6/2, 6/3, 6/4 and moist color of 10YR 3/2, 4/2, 4/3, 5/2, or 5/3. Texture is sandy loam, coarse sandy loam or coarse loamy sand and contains 40 to 65 percent by volume pumice gravel mainly of the less than 0.6 inch size. The pumice overburden C horizon, if present, has dry color of 10YR 6/3, 6/4, 7/2, 7/.3, 8/2 or 8/3 and moist color of 10YR 5/3, 5/4, 6/3, 7/2, or 7/3. Texture is coarse sand, coarse loamy sand or coarse sandy loam and contains 60 to 90 percent by volume pumice gravel mainly of the 0.2 to 1.0 inch size. The shallower pumice overburden areas are usually mixed with the older buried soil material. The pumice overburden pH is neutral to slightly acid.

The loamy textured mixed minerology soil beneath the pumice overburden has an A-B horizon development.

The A horizon is 3 to 6 inches thick and has dry color of 10YR 5/4, 6/3, 6/4; 7.5YR 5/4, 5/6 and moist color of 10YR 3/4, 4/2, 4/3; 7.5YR 3/4, 4/2. Texture is loam or sandy loam and contains 10 to 30 percent by volume basalt gravel. Structure is subangular blocky and soil pH is neutral.

The B horizon has dry color of 10YR 6/2, 6/3, 6/4 and moist color of 10YR 3/4, 4/2, 4/3, 4/4. Texture is loam or clay loam and contains from 10 to 35 percent by volume coarse fragments of basalt. Structure is subangular blocky and soil pH is neutral.

CASUSE FAMILY

The Casuse family consists of shallow, well drained soils which formed over volcanic tuff. Permeability is moderate. These soils are on volcanic plateaus and mountain sideslopes with slopes of 5 to 30 percent. They occur at elevations of 4500 to 5300 feet. The annual precipitation is 14 to 16 inches which mostly falls during the winter as snow. The mean annual air temperature is 46 to 49°F. The frost free season is 80 to100 days.

Taxonomic Class: Loamy, mixed, mesic, shallow, Xeralfic Haplargids.

Reference Pedon: Casuse family loam on an east facing 5 percent sideslope of an undulating volcanic plateau at 5050 feet elevation under western juniper, low sagebrush, big sagebrush, rabbitbrush and bunchgrass rangeland. Soil was dry when described on 8/21/79. (Colors are for dry soil unless otherwise noted.)

A11–0 to 2 inches; light gray (10YR 7/2) loam, grayish brown (10YR 5/2) moist; weak to moderate fine and medium subangular blocky structure which parts into moderate very fine and fine granular; soft, very friable, slightly sticky and slightly plastic; common very fine and fine roots; common very fine and medium and few coarse vesicular pores; neutral (pH 6.8); gradual wavy boundary.

A12–2 to 5 inches; light brownish gray (2.5Y 6/2) loam, dark grayish brown (2.5Y 4/2) moist; moderate fine and medium subangular blocky structure which parts into moderate fine and medium granular; slightly hard, friable, sticky and plastic; common very fine and fine and few medium roots; many very fine and fine, common medium pores; neutral (pH 6.8); clear smooth boundary.

B21t–5 to 10 inches; pale brown (10YR 6/3) clay loam, dark grayish brown (10YR 4/2) moist; weak to moderate subangular blocky structure which parts into moderate medium granular; slightly hard, friable, sticky and plastic; few thin clay films on ped faces; 5 percent gravel by volume; many very fine and fine, common medium and few coarse roots; many very fine and fine, few medium and coarse pores; neutral (pH 7.0); clear smooth boundary.

B22t–10 to 14 inches; pale brown (10YR 6/3) very gravelly clay loam, brown (10YR 4/3) moist; moderate to strong fine and medium subangular and angular blocky structure; hard, friable, sticky and plastic; common thin clay films on ped faces; 40 percent tuff gravel by volume; common very fine, fine and medium roots; common to many fine and very fine tubular pores; neutral (pH 7.2); abrupt smooth boundary.

Cr–14 plus inches; moderately to slightly weathered platy tuff.

Reference Pedon Location: Modoc County, California, about 30 feet east of road and about 1700 feet west and 300 feet south of the NE corner in Section 20, T.39N., R.14E.

Range in Characteristics: Depth to paralithic tuff ranges from 7 to 20 inches. The control section averages 22 to 35 percent clay. Coarse fragments range from 5 to 35 percent by volume in the control section. The mean annual soil temperature at the paralithic contact is about 48 to 52°F. and fluctuates by more than 9°F. during the year. The soil temperature at the contact exceeds 41°F. from April 1 through December 1. The soils 4 to 12 inch moisture control section, or to the paralithic contact if shallower, is usually dry in all parts from June 15 through November 15, and moist in all parts from December 15 through May 1.

The A horizon is 2 to 6 inches thick with dry color of 10YR 5/2, 5/4, 6/2, 6/3, 7/2; 7.5YR 6/2, 6/4, 7/2; 2.5Y 5/2 or 6/2, and moist color of 10YR 3/4, 4/2, 4/3, 6/2; 7.5YR 4/2, 4/4, 5/2; 2.5Y 4/2. Texture is loam or fine sandy loam and may contain 0 to 20 percent by volume coarse fragments. Structure is granular, platy, or subangular blocky and soil pH is slightly acid to neutral.

The B horizon has dry color of 10YR 5/4, 6/2, 6/3; 7.5YR 6/2, 6/4 and moist color of 10YR 3/4, 4/2, 4/3, 4/4, 5/2; 7.5YR 4/2. Texture is loam or clay loam and contains 5 to 35 percent by volume coarse fragments mainly of gravel size.

The Cr paralithic contact consists of volcanic tuff which is usually platy in the upper parts and becomes massive with depth. It can be cut with a spade.

CAVANAUGH FAMILY

The Cavanaugh family consists of deep and moderately deep, well drained soils which weathered from andesite, basalt and volcanic tuff. Permeability is slow. These soils are on 10 to 65 percent slopes and occur on toeslopes, smooth and hummocky sideslopes or incized drainages of volcanic plateaus and mountain uplands at 5500 and 7200 feet elevation. The climate is cool with 40 to 46°F. mean annual air temperature and 20 to 30 inches annual precipitation which mostly falls as snow during the winter. The frost free season is 60 to 90 days.

Taxonomic Class: Clayey-skeletal, montmorillonitic, frigid, Ultic Argixerolls.

Reference Pedon: Cavanaugh family cobbly loam on an east facing 20 percent smooth mountain sideslope at 6450 feet elevation under a closed canopy of white fir and ponderosa pine with a sparce understory of current spp., snowberry, oregon grape, vetch and lupine. Soil was moist below 19 inches when described on 9/8/80. (Colors are for dry soil unless otherwise stated.)

01–1 to 0 inches; white fir and ponderosa pine needles and twigs.

A11–0 to 7 inches; dark brown (10YR 4/3) cobbly loam, very dark brown (10YR 2/2) moist; weak to moderate fine and medium platy structure which parts into moderate fine granular; slightly hard, friable, slightly sticky and slightly plastic; 15 percent cobbles and gravel by volume; common very fine and fine, few medium and coarse roots; slightly acid (pH 6.4); clear smooth boundary.

A12–7 to 13 inches; brown (10YR 4/3) very cobbly loam, very dark grayish brown (10YR 3/2) moist; moderate fine and medium subangular blocky structure; slightly hard; friable, slightly sticky and slightly plastic; few clay films on ped faces; 25 percent gravel and 15 percent cobbles by volume; common very fine and fine and few medium and coarse roots; common very fine and fine pores; slightly acid (pH 6.4); gradual wavy boundary.

B21t–13 to 18 inches; brown (10YR 5/3) very cobbly clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine and medium angular and subangular blocky structure; hard, friable, sticky and plastic; common moderately thick clay films on ped faces and pores; 25 percent gravel and 20 percent cobbles by volume; common very fine, fine, medium and coarse roots; many very fine, and fine, and common medium pores; neutral (pH 6.6); clear wavy boundary.

B22t–18 to 27 inches; yellowish brown (10YR 5/4) very gravelly clay, dark yellowish brown (10YR 3/4) moist; moderate to strong fine and medium angular and subangular blocky structure; hard, firm, very sticky and plastic; common moderately thick clay films on ped faces and pores; 40 percent gravel and 15 percent cobbles by volume; few to common very fine, fine and coarse and common medium roots; common very fine and fine and few medium pores; neutral (pH 6.6); gradual wavy boundary.

B3t–27 to 60 inches; yellowish brown (10YR 5/4) extremely gravelly clay loam, dark yellowish brown (10YR 3/4) moist; moderate to strong fine and medium angular and subangular blocky structure; hard, firm, very sticky and plastic; common moderately thick clay films on ped faces and pores; 45 percent gravel and 15 percent cobbles by volume; few very fine, fine, and medium roots; common very fine and fine and few medium pores; neutral (pH 6.8).

Reference Pedon Location: Modoc County, California, about 50 feet north of road and about 300 feet east and 2100 feet south of NW corner of Section 5, T.41N., R.15E.

Range in Characteristics: Depth to bedrock is greater than 30 inches. ay content in the control section averages 35 to 50 percent. Base saturation by the ammonium acetate method is estimated to be 60 to 75 percent in the A horizon and at least the upper part of the B horizon. The mean annual soil temperature at a depth of 20 inches is 42 to 47°F. and fluctuates by more than 9°F. during the year. The soil temperature at 20 inches exceeds 41°F. from May 15 through November 15 and exceeds 47°F. from June 15 through October 15 in most years. The 5 to 15 inch moisture control section is moist in all parts from about November 15 through May 30. It is dry in all parts from about August 1 through October 20 in most years.

The A horizon is 6 to 13 inches thick with dry color of 10YR 4/2, 4/3, 5/2, 5/3 and moist color of 10YR 2/2, 3/2, 3/3 or 7.5YR 3/2. Texture is loam or clay loam and contains between 15 to 50 percent by volume gravel, cobbles and some stones. Structure is platy, granular, or subangular blocky and soil pH is moderately acid to neutral.

The B horizon normally makes up the remainder of the soil and have dry color of 10YR 4/3, 5/3, 5/4, 6/3; 7.5YR 5/4, and moist color of 10YR 3/2, 3/3, 3/4, 4/2, 4/3, 4/4; 7.5YR 3/2 or 3/4. The upper part of the argillic B horizon is normally mollic in color. Texture is

clay loam, silty clay or clay and contains from 35 to 60 percent by volume rock fragments mainly of cobble and gravel size with some stones normally present. Structure is subangular and angular blocky and soil pH is slightly acid to neutral.

CHEADLE FAMILY

The Cheadle family consists of shallow, well drained soils that weathered from andesite or hard volcanic tuff. Permeability is moderate. These soils are on 10 to 90 percent slopes and occur mainly on convex sideslopes, knolls and ridges of mountain uplands at elevations of 7000 to 9900 feet. The climate is cold with a mean annual air temperature of 34 to 40°F. Annual precipitation is 25 to 35 inches most of which falls as snow in witner. The frost free season is less than 30 days to 70 days.

Taxonomic Class: Loamy-skeletal, mixed, Lithic Cryoborolls.

Reference Pedon: Cheadle family very cobbly loam on a southwest facing, 11 percent upper sideslope at 7280 feet elevation under Idaho fescue with big sagebrush, rabbitbrush, mule ears, arrowleaf balsom root and various forbs. Soil was moist to 12 inches when described on 11/4/80. (Colors are for dry soil unless otherwise stated.)

A11–0 to 6 inches; dark grayish brown (10YR 4/2) very cobbly loam, very dark brown (10YR 2/2) moist; moderate fine and medium granular structure; slightly hard, very friable, sticky and slightly plastic; 35 percent cobbles and gravel by volume; many very fine and fine roots; neutral (pH 6.6); clear wavy boundary.

A12–6 to 12 inches; dark grayish brown (10YR 4/2) very cobbly loam; very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure which parts into moderate fine granular; slightly hard, very friable, sticky and slightly plastic; 20 percent cobbles and 30 percent gravel by volume; many very fine and fine roots; common very fine and fine pores; neutral (pH 6.6); clear smooth boundary.

A13–12 to 17 inches; brown (10YR 5/3) very cobbly clay loam; dark brown (10YR 3/3) moist; moderate fine subangular blocky structure; hard, friable, sticky and plastic; few thin clay films on ped faces and pores; 20 percent cobbles and 35 percent gravel by volume; common very fine and fine roots; many very fine and fine pores; neutral (pH 6.6); abrupt smooth boundary.

R–17 plus inches; hard fractured andesite.

Reference Pedon Location: Modoc County, California, on Bald Mountain, about 400 feet west and 800 feet north of the SE corner of Section 24, T.44N., R.14E.

Range in Characteristics: Depth to the lithic contact is 8 to 20 inches. The mean annual soil temperature at the lithic contact is about 36 to 42°F. and the mean summer temperature at the contact is about 50 to 59°F. The soil temperature at the lithic contact exceeds 41°F. from June 1 through November 15 and exceeds 47°F. from June 15 through October 15 in most years. The soils 5 to 15 inch moisture control section, or to the lithic contact if shallower, is usually moist in all parts from November 1 through June 15 and dry in all parts from August 10 through October 10. Clay content in the control section averages 20 to 28 percent.

The A horizon normally occupies the whole soil depth and have dry color of 10YR 4/2, 4/3, 4/4, 5/2, 5/3; 7.5YR 4/2, 4/4 or 5/4 and have moist color of 10YR 2/2, 3/2, 3/3; 7.5YR 3/2. Texture is loam or light clay loam and contains from 35 and 60 percent by volume rock fragments normally of the cobble and gravel size with some stones. Structure is granular or subangular blocky and soil pH is slightly acid to neutral.

COWICHE FAMILY

The Cowiche family consists of moderately deep, well drained soils that formed in material derived from basalt or volcanic tuff. Permeability is moderate. These soils are found on basalt plateaus and toeslopes of mountain uplands of 1 to 20 percent slope. Elevation ranges from 4300 to 5300 feet and the annual precipitation is 10 to 16 inches most of which falls as snow in winter. The annual air temperature is 46 to 49°F. and the frost free season is 80 to 110 days.

Taxonomic Class: Fine-loamy, mixed, mesic, Aridic Argixerolls.

Reference Pedon: Cowiche loam on a 15 percent southeast facing sideslope at 4900 feet elevation under western juniper, big sagebrush, mule ears, Idaho fescue and cheatgrass rangeland. Soil was moist below 6 inches when described on 6/8/79. (Colors are for dry soil unless otherwise stated.)

A11–0 to 2 inches; brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; weak fine platy structure which parts into weak fine granular; soft, friable, slightly sticky and non-plastic; many fine and very fine roots; many fine and very fine tubular continuous pores; slightly acid (pH 6.2); clear, smooth boundary.

A12–2 to 6 inches; grayish brown (10YR 5/2) loam, dark brown (7.5YR 3/2) moist; moderate fine and medium platy structure which parts to moderate fine granular; slightly hard, friable, sticky and slightly plastic; common fine and very fine roots; many fine, very fine and common medium tubular continuous pores; 5 percent gravel and cobbles by volume; slightly acid (pH 6.4); clear, smooth boundary.

B21t–6 to 11 inches; brown (10YR 5/3) clay loam, dark brown (10YR 3/3) moist; weak to moderate fine and medium subangular blocky structure; slightly hard, friable, sticky and plastic; few faint clay skins on ped faces; common very fine, fine and medium roots; common fine and very fine tubular continuous pores; 5 percent gravel and cobbles by volume; slightly acid (pH 6.4); gradual, wavy boundary.

B22t–11 to 16 inches; dark yellowish brown (10YR 4/4) clay loam, dark brown (7.5YR 3/4) moist; moderate fine and medium subangular blocky structure; hard, friable, sticky and plastic; common distinct clay skins on ped faces and pores; common fine, very fine and medium roots; common very fine and fine tubular continuous pores; slightly acid (pH 6.4) clear, smooth boundary.

B3t–16 to 25 inches; brownish yellow (10YR 6/6) gravelly clay loam, strong brown (7.5YR 4/6) moist; moderate medium angular blocky structure; hard, friable, sticky and plastic; many distinct clay skins on ped faces and in pores; 30 percent by volume highly weathered cinder and tuff gravel; few to common very fine and fine roots; common fine and very fine tubular continuous pores; slightly acid (pH 6.4) abrupt, smooth boundary.

Cr–25 plus inches; moderately weathered in place fractured volcanic tuff with clay skins on fractured faces. Tuff can be dug with a spade.

Reference Pedon Location: Modoc County, California, about 300 feet east and 2400 feet south of the NW corner of Section 24, T.48N., R.6E.

Range in Characteristics: Depth to bedrock of volcanic tuff or basalt is 20 to 40 inches. The mean annual soil temperature at 20 inches is about 48 to 52°F. and fluctuates by more than 9°F. during the year. The soil temperature at 20 inches exceeds 41°F. from April 1 through December 1 in most years. The 4 to 12 inch soil moisture control section is usually dry in all parts from June 15 through November 15 and moist in all parts from December 15 through May 1. The average clay content in the control section is 24 to 35 percent.

The A horizon is 4 to 9 inches thick and have dry color of 10YR 4/2, 4/3, 5/2, 5/3, 5/4 and moist color of 10YR 3/2, 3/3; 7.5YR 3/2. Texture is loam or sandy loam and normally contains less than 15 percent coarse fragments; structure is platy or granular and soil pH is slightly acid to neutral.

The B horizon normally makes up the rest of the soil and has dry color of 10YR 5/2, 5/3, 5/4, 4/3, 4/4, 6/3, 6/4, 6/6; 7.5YR 5/4, 6/4 and moist color of 10YR 3/2, 3/3, 3/4, 4/3, 4/4; 7.5YR 3/2, 3/4, 4/2, 4/4 or 4/6. The upper part of the argillic B horizon is mollic in color. Texture is loam and clay loam and contain less than 35 percent by volume coarse fragments. Structure is subangular and angular blocky and soil pH is slightly acid to neutral.

The Cryoborolls, wet phase soils consist of moderately deep to very deep, poorly drained soils that formed in alluvial and colluvial material derived from basalt, andesite or volcanic tuff rock sources. Permeability is moderate to slow. These soils are on broad toeslopes and drainageways and lower sideslopes of mountain uplands at 7,000 to 8,500 feet elevation and on 10 to 30 percent slopes. Annual precipitation is 25 to 35 inches most of which falls as snow during winter. Mean annual air temperature is 34 to 40°F. and the frost free growing season is 30 to 70 days.

Taxonomic Class: Cryoborolls (wet phase)

Reference Pedon: NOTE: The following pedon description is not necessarily intended to be the modal concept, but only as a reference pedon. Cryoborolls, wet gravelly loam on a 10 percent southwest facing toeslope adjacent to a narrow drainageway at 7,800 feet elevation under quaking aspen, montaine shrubs, skunk cabbage, sedges and grass. Soil was moist throughout and saturated below 23 inches when described on 8/21/80. (Colors are for dry soil unless otherwise stated.)

A11–0 to 8 inches; very dark gray (10YR 3/1) gravelly loam, black (10YR 2/1) moist; moderate fine granular structure; slightly hard, friable, slightly sticky and non-plastic; 25 percent by volume andesite gravel; many fine, very fine and common medium roots; neutral (pH 6.6); clean smooth boundary.

A12–8 to 14 inches; dark grayish brown (10YR 4/2) very gravelly loam, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure which parts to moderate fine granular; slightly hard, very friable, slightly sticky and slightly plastic; 45 percent by volume andesite gravel; many fine, very fine and common medium roots; common fine and medium pores; slightly acid (pH 6.2) clear smooth boundary.

A13g–14 to 23 inches; brown (10YR 4/3) very gravelly loam, very dark grayish brown (10YR 3/2) moist; few distinct fine yellowish brown (10YR 5/6) mottles; moderate fine subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; 40 percent gravel and 5 to 10 percent cobbles by volume; common fine, very fine and medium roots; common fine and very fine pores; medium acid (pH 6.0); abrupt smooth boundary.

Cg–23 to 35 inches; grayish brown (2.5Y 5/2) extremely cobbly loam, dark grayish brown (2.5Y 4/2) moist; few distinct fine and medium light olive brown (2.5Y 5/6) to yellowish brown (10YR 5/8) mottles; massive, slightly hard, very friable, slightly sticky and slightly plastic; 30 percent cobbles and 35 percent gravel by volume; few fine, very fine and medium roots; medium acid (pH 6.0); abrupt wavy boundary.

R–35 plus inches hard fractured andesite bedrock.

Reference Pedon Location: Modoc County, California, about 1300 feet west and 1500 feet south of the NE corner of Section 7, T.39N., R.16E.

Range in Characteristics: Depth to bedrock is greater than 20 inches. year round fluctuating apparent water table exists within 10 to 30 inches of the soil surface with a capillary fringe at or near the surface. The soil temperature at the 20 inch depth is above 41°F. from about July 1 through October 30 in most years and the mean annual soil temperature at that depth is about 36 to 42°F. The mean summer soil temperature at 20 inches is less than 55°F. Clay content in the control section averages 20 to 45 percent and rock fragments average 15 to 60 percent by volume.

The A horizon is 14 to 30 inches thick and have dry color of 10YR 3/2, 4/1, 4/2, 4/3, 5/2; 2.5Y 4/2 and moist color of 10YR 2/1, 2/2, 3/2, 3/3; 2.5Y 3/2. Texture is sandy loam, loam, clay loam and contain 0 to 50 percent by volume coarse fragments. Structure is platy, granular or subangular blocky and soil pH is medium acid to neutral.

The B horizon, if present, has dry color of 10YR 4/3, 4/4, 5/3, 5/4; 2.5Y 4/4, 5/4 and moist color of 10YR 3/2, 3/3, 3/4, 4/2, 4/3; 2.5Y 3/2, 4/2, 4/4. Texture is loam, clay loam or clay and contains from 15 to 50 percent by volume rock fragments. Structure is subangular or angular blocky or prismatic and soil pH is medium acid to neutral.

The C horizon has dry color of 10YR 5/1, 5/2, 6/2; 2.5Y 5/j2, 6/2 and moist color of 10YR 4/2, 5/2, 5/3; 2.5Y 4/2, 4/4. Few to common to many distinct light olive brown to yellowish brown mottles are evident throughout the C horizon. Texture is sandy loam, loam or clay loam and contain 25 to 70 percent by volume rock fragments. It is massive and soil pH is medium acid to slightly acid.

DEMASTERS FAMILY

The DeMasters family soils consist of deep and a limited amount of moderately deep, well drained soils that formed in material weathered mainly from basalt. Permeability is moderately slow. These soils are on sideslopes and toeslopes of mountain uplands with slopes ranging from 1 to 35 percent. Elevation ranges from 5400 to 7500 feet. The annual precipitation is 20 to 30 inches most of which falls during the winter as snow. Mean annual air temperature is 40 to 46°F. The frost free season is 60 to 90 days.

Taxanomic Class: Fine-loamy, mixed, frigid, Pachic Ultic Argixerolls.

Reference Pedon: DeMasters family loam on a 10 percent southeast facing mountain sideslope at 6200 feet elevation under a white fir forest with some ponderosa pine and a sparce understory of snowbrush, vetch and various grasses. Soil was dry when described on 8/24/79. (Colors are for dry soil unless otherwise stated).

01–1-1/2 to 0 inches; Ponderosa pine and white fir needles and twigs.

A11–0 to 10 inches; brown (7.5YR 4/2) loam, dark reddish brown (5YR 2.5/2) moist; weak medium subangular blocky structure parting to moderate fine and very fine granular; soft, very friable, sticky and slightly plastic; 10-15 percent basalt gravel; many fine very fine and common medium and coarse roots; slightly acid (pH 6.4); gradual wavy boundary.

A12–10 to 14 inches; brown (7.5YR 4/2) loam, dark reddish brown (5YR 2.5/2) moist; weak medium subangular blocky structure parting to moderate fine and medium granular; soft, very friable, sticky and slightly plastic; about 5 percent by volume basalt gravel; many fine, very fine, common medium and few coarse roots; medium acid (pH 5.6); clear smooth boundary.

B21t–14 to 24 inches; brown (7.5YR 4/2) gravelly clay loam, dark brown (7.5YR 3/2) moist; moderate medium and coarse subangular blocky structure parting to moderate medium granular; slightly hard, friable, sticky and plastic; few thin clay skins on ped faces; 15 percent gravel by volume of basalt and ash; common to many fine, very fine medium and coarse roots; many very fine and fine and few medium tubular pores; neutral (pH 6.8); clear wavy boundary.

B22t–24 to 37 inches, brown (10YR 4/3) gravelly clay loam; dark brown (7.5YR 3/2) moist; moderate fine and medium subangular blocky structure parting to strong fine and medium granular; hard, friable, sticky and plastic; few thin clay skins on ped faces; 5 percent cobbles and 25 percent gravel by volume of basalt; common very fine, fine, medium and coarse roots; many fine and very fine tubular pores; neutral (pH 6.8); gradual wavy boundary.

IIB3t–37 to 60 inches; dark yellowish brown (10YR 4/4) extremely cobbly clay loam; dark brown (7.5YR 3/4) moist; moderate fine and medium subangular blocky structure; hard, friable, sticky and plastic; few thin clay skins on ped faces; 60 percent cobbles and 15 percent gravel by volume of basalt; few very fine, fine, medium and coarse roots, many very fine and fine tubular pores; neutral (pH 6.8).

Reference Pedon Location: Modoc County, California, about 500 feet east and 1800 feet north of SW corner of Section 17, T.40N., R.15E.

Range in Characteristics: Depth to bedrock is generally greater than 40 inches but ranges from 20 to 40 inches in some pedons in map unit 147. The control section averages 20 to 35 percent clay content and coarse fragments range from 5 to 35 percent by volume. Base saturation by the ammonium acetate method is estimated to be between 50 and 75 percent throughout the upper 30 inches of the soil. The mean annual soil temperature at a depth of 20 inches is 41 to 47°F. and fluctuates by more than 9°F. during the year. The soil temperature at the 20 inch depth exceeds 41°F. from May 15 through November 15 and exceeds 47°F. from June 15 through October 15 in most years. The 4 to 12 inch soil moisture control section is usually moist in all parts from November 15 through May 30 and dry in all parts from August 1 through October 20.

The A horizon is 9 to 22 inches thick with dry color of 7.5YR 4/2, 4/4; 5YR 4/2, 4/3, 4/4; 10YR 4/3 or 4/4 and moist color of 7.5YR 3/2; 5YR 2.5/2, 3/2, 3/3; 10YR 3/2 or 3/3. Texture is loam and contains from 5 to 30 percent by volume gravel and a few cobbles. Structure is granular, or subangular blocky and soil pH is medium acid to slightly acid.

The B horizon makes up the remaining soil and has dry color of 10YR 4/2, 4/3, 4/4, 5/3, 5/4; 7.5YR 4/2, 4/4, 5/4; 5YR 4/3, 4/4, 5/3, 5/4 and moist color of 10YR 3/2, 3/3, 3/4; 7.5YR 3/2, 3/4, 4/4; 5YR 3/3, 3/4, 4/3 or 4/4. The upper parts of the argillic B horizon has mollic colors and may include the whole soil profile. Texture is loam or clay loam and contains from 5 to 75 percent by

volume rock fragments which increase in amount with depth. Structure is subangular blocky and soil pH is slightly acid to neutral.

DEVEN FAMILY

The Deven family consists of shallow, well drained soils that formed in material weathered from basalt, andesite and volcanic tuff. Permeability is slow. These soils are found primarily on basalt plateaus and mountain sideslopes of volcanic origin at an elevation of 4300 to 6000 feet. Slopes range from 1 to 40 percent. The annual precipitation is 10 to 20 inches most of which falls during winter as snow. The mean annual air temperature is 44 to 49°F. The frost free season is 80 to 110 days.

Taxonomic Class: Clayey, montmorillonitic, mesic, Lithic Argixerolls.

Reference Pedon: Deven family cobbly loam on a nearly level basalt plateau at 4920 feet elevation under western juniper, bitterbrush and cheatgrass rangeland. Soil was dry throughout when described on 8/24/73. (Colors are for dry soil unless otherwise noted.)

A1–0 to 2 inches; brown (10YR 5/3) cobbly loam, dark brown (7.5YR 3/2) moist; moderate fine granular structure; soft, very friable, slightly sticky and slightly plastic; common very fine roots; many very fine interstitial pores; 10 percent cobbles and 10 percent gravel by volume; slightly acid (pH 6.3); clear smooth boundary.

B1t–2 to 7 inches; dark brown (7.5YR 4/2) heavy clay loam, dark brown (7.5YR 3/2) moist; moderate medium and coarse subangular blocky structure; hard, very friable, sticky and plastic; common very fine, fine and medium roots; common very fine tubular and few very fine interstitial proes; many moderately thick clay films on peds and in pores; slightly acid (pH 6.5); clear wavy boundary.

B2t–7 to 16 inches; dark reddish borwn (5YR 3/4) light clay, dark reddish brown (5YR 3/2) moist; moderate medium and coarse angular blocky structure; hard, very friable, sticky and plastic; few very fine, common fine and medium roots; few very fine tubular and interstitial pores; continuous moderately thick clay films on peds and in pores; slightly acid (pH 6.5); abrupt irregular boundary.

R–16 to 24 inches; gray (N/5) hard fractured basalt.

Reference Pedon Location: Modoc County, California; about 5 miles west of Alturas; about 0.9 miles south on Crowder Flat Road from the Modoc National Forest boundary and 75 feet east of the road in the NE 1/4 of SW1/4, Section 6, T.42N., R.12E. (State Modal)

Range in Characteristics: Depth to a lithic contact of basalt, andesite or volcanic tuff is 8 to 20 inches. In some areas where Deven has been mapped, notably in the southwestern portion of the survey area, much of it is over a softer type volcanic tuff which may be cut with a shovel. Clay content in the control section averages 35 to 60 percent and coarse fragments may occupy up to 35 percent by volume. The mean annual soil temperature at the lithic contact is about 47 to 52°F. and fluctuates by more than 9°F. during The year. The soil temperature at the lithic contact exceeds 41°F. from April 1 through December 1. Where this soil is mapped with map units 132, 151, 153, 158, 208, 221, 242 and 251 the 4 to 12 inch soil moisture control section, or to the lithic contact if shallower, is usually dry in all parts from June 15 through November 15, and moist in all parts from December 15 through May 1. Where this soil is mapped in other map units the moisture control section is usually dry in all parts from July 1 through October 30, and moist in all parts from December 1 through May 1.

The A horizon is 2 to 7 inches thick and have dry color of 10YR 4/2, 4/3, 5/2, 5/3, 5/4; 7.5YR 4/2, 5/2, 5/4, and moist color of 10YR 3/2, 3/3; 7.5YR 3/2; 2.5Y 3/2. Texture is loam or clay loam with 0 to 70 percent surface rock fragments predominately of the gravel and cobble size with some larger stones. Structure is granular or platy and soil pH is slightly acid to neutral.

The B horizon makes up the remainder of the soil with dry color of 10YR 4/2, 4/3, 5/2, 5/3, 5/4, 6/2, 6/3; 7.5YR 4/2, 5/2, 5/4; 5YR 3/4, 4/2 or 4/3 and moist color of 10YR 3/2, 3/3, 3/4, 4/2, 4/3; 7.5YR 3/2, 3/4, 4/2, 4/4; 5YR 3/2, 3/3 or 3/4. Mollic colors make up at least the upper 7 inches of soil and can include the whole soil depth. Texture is clay loam or clay and normally contains only a trace of rock fragments but may contain up to 35 percent by volume in some pedons. Structure is prismatic or subangular or angular blocky and soil pH is slightly acid to neutral.

Additional Data: Riverside Laboratory, Pedon S73 Calif 25-10.

DISHNER FAMILY

The Dishner family consists of shallow, well drained soils that formed in material derived from basalt. Permeability is slow. These soils are found on basalt plateaus with 1 to 15 percent slopes at an elevation of 4300 to 5500 feet. The annual precipitation is 10 to 16 inches most of which falls during winter as snow. The mean annual air temperature is 45 to 49°F. The frost free season is 80 to 110 days.

Taxomonic Class: Clayey, montmorillonitic, mesic, Lithic Xerollic Haplargids.

Reference Pedon: Dishner family cobbly sandy clay loam on a west facing 10 percent sloping basalt plateau at 4320 feet elevation under rabbitbrush, cheatgrass, wheatgrass and bottlebrush rangleand. Soil was dry throughout when described on 11/6/81. (Colors are for dry soil unless otherwise stated.)

A1–0 to 5 inches; light brownish gray (10YR 6/2) cobbly sandy clay loam, dark brown (10YR 3/3) moist; moderate fine and medium platy structure which parts into granular; slightly hard, friable, slightly sticky and slightly plastic; 15 percent cobbles and 5 to 10 percent gravel by volume; common very fine and fine and few medium roots; common very fine and fine and many medium vesicular pores; neutral (pH 6.8); clear smooth boundary.

B1t–5 to 9 inches; pale brown (10YR 6/3) silty clay loam, dark yellowish brown (10YR 3/4) moist; weak to moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few to common moderately thick clay films on pores and ped faces; 5 to 10 percent gravel and less than 5 percent cobbles by volume; few to common very fine, fine and medium roots; few to common very fine and fine pores, neutral (pH 6.8); clear smooth boundary.

B21t–9 to 12 inches; yellowish brown (10YR 5/4) clay loam, dark yellowish brown (10YR 3/4) moist; moderate fine and medium subangular blocky structure; hard, firm, sticky and plastic; common moderately thick clay films on pores and ped faces; 5 to 10 percent gravel and 5 percent cobbles by volume; few very fine, fine and medium roots; few to common very fine and fine pores; neutral (pH 7.0); clear smooth boundary.

B22t–12 to 16 inches; yellowish brown (10YR 5/4) cobbly clay, dark yellowish brown (10YR 4/4) moist; strong fine and medium subangular blocky structure; hard, firm, sticky and plastic; many thick clay films on pores and ped faces; 10 percent cobbles and 5 percent gravel by volume; few fine and medium roots; few very fine and fine pores; neutral (pH 7.2); abrupt smooth boundary.

R–16 plus inches; hard vesicular basalt.

Reference Pedon Location: Siskiyou County, California, about 50 feet south and 250 feet west of the NE corner of Section 36, T.46N., R.3E.

Range in Characteristics: Depth to bedrock is 8 to 20 inches. Clay content in the control section averages 35 to 50 percent and coarse fragment content may comprise up to 25 percent by volume. The mean annual soil temperature at the lithic contact is about 47 to 52°F. and fluctuates by more than 9°F. during the year. The soil temperature at the lithic contact exceeds 41°F. from April 1 through December 1 of most years. The 4 to 12 inch soil moisture control section, or to the lithic contact if shallower, is usually dry in all parts from June 15 through November 15, and moist in all parts from December 15 through May 1.

The A horizon is 2 to 5 inches thick with dry color of 10YR 5/3, 5/4, 6/2, 6/3; 7.5YR 5/2, 5/4, 6/2, 6/4 and moist color of 10YR 3/3, 3/4, 4/2, 4/3; 7.5YR 3/4 or 4/2. Texture is loam, sandy clay loam, or clay loam with 15 to 50 percent surface rock fragments predominately of the gravel and cobble size with occasional larger stones. Structure is platy, vesicular, or granular and soil pH is neutral.

The B horizon makes up the remainder of the soil with dry color of 10YR 5/3, 5/4, 6/3, 6/4; 7.5YR 4/4, 5/3, 5/4, 6/3 and moist color of 10YR 3/4, 4/3, 4/4; 7.5YR 3/4, 4/4. Texture is clay loam, silty clay loam or clay and may contain up to 25 percent by volume gravel and cobbles. Structure is subangular and angular blocky and soil pH is neutral.

DITCHCAMP FAMILY

The Ditchcamp family consists of moderately deep, well drained soils that formed in aeolian material derived from basalt, andesite and tuff. Permeabiity is slow. These soils are underlain by a silica duripan at a depth of 20 to 35 inches. These soils are on hummocky basalt plateaus with 3 to 10 percent slopes at elevations of 4400 to 5500 feet. Ditchcamp soils occupy the mounds where hummocky relief occurs. Basalt rock usually underlays the duripan at depths of 20 to 40 inches. Annual precipitation is 12 to 14 inches most of which falls in winter as snow. Mean annual air temperature is 44 to 48°F. The frost free season is 90 to 110 days.

Taxonomic Class: Fine-loamy, mixed, mesic, Xerollic Durargids.

Reference Pedon: Ditchcamp family loam under western juniper and bunchgrass rangeland.

A11–0 to 7 inches; brown (10YR 5/3) heavy loam, dark brown (10YR 3/3) moist; moderate thick and very thick platy structure; hard, very friable, slightly sticky, slightly plastic; common very fine roots; many very fine interstitial, few very fine and fine tubular pores; slightly acid (pH 6.5); clear smooth boundary.

A12–7 to 15 inches; borwn (7.5YR 5/4) heavy loam, dark brown (10YR 3/3) moist; weak medium and coarse subangular blocky structure; hard, very friable, slightly sticky, slightly plastic; common very fine roots; few very fine interstitial and common very fine tubular pores; few thin clay films appear as stains on mineral grains; slightly acid (pH 6.5) clear wavy boundary.

B1t–15 to 26 inches; brown (7.5YR 5/4) light clay loam, dark brown (10YR 3/3) moist; weak medium subangular blocky structure; very hard, very friable, sticky, slightly plastic; common very fine roots; few very fine interstitial and many very fine tubular pores; common thin clay films line pores and form bridges; slightly acid (pH 6.5); clear smooth boundary.

B2t–26 to 30 inches; brown (7.5YR 5/4) light clay loam, dark yellowish brown (10YR 3/4) moist; moderate coarse angular blocky structure; very hard, very friable, sticky, slightly plastic; many very fine tubular and few very fine interstitial pores; many thin clay films on faces of peds, and lining pores, and many moderately thick clay films form bridges; 2 percent basalt gravel by volume; slightly acid (pH 6.3); abrupt; smooth boundary.

Csim–30 to 34 inches; reddish yellow (7.5YR 7/6) strong cemented duripan with 0.5 mm laminar bands; medium common distinct manganese bodies of very dark gray (N 3/); strong thick and very thick platy structure; extremely hard; abrupt wavy boundary.

R–34 to 35 plus inches; fractured basalt rock.

Reference Pedon Location: Modoc County, California; about 11.4 miles north of Modoc National Forest boundary on Crowder Flat Road, or 2,000 feet north from Whittemore Springs Road and 110 feet west of Crowder Flat Road in the NE1/4 of NW1/4, Section 16, T.44N., R.11E. (State Modal)

Range in Characteristics: Depth to silica duripan ranges from 20 to 35 inches. The silica duripan is generally only a few millimeters to a foot in thickness and is underlain by basalt. The control section averages 30 to 35 percent clay. The mean annual soil temperature at 20 inches is about 47 to 52°F. and fluctuates by more than 9°F. during the year. The soil temperature at the 20 inch depth exceeds 41°F. from April 1 through December 1. The 4 to 12 inch moisture control section is usually dry in all parts from June 15 through November 15, and moist in all parts from December 15 through May 1. The upper 7 inches of soil averages less than 1 percent organic matter.

The A horizons are 3 to 15 inches thick with dry color of 10YR 4/3, 5/3, 6/2, 6/3, 6/4; 7.5YR 4/4, 5/2, /54; 5YR 4/4 and moist color of 10YR 3/3, 3/4, 4/2, 4/3; 7.5YR 3/2, 3/4; 5YR 3/4. Textures are loam or fine sandy loam and may contain up to 20 percent surface coarse fragments. Structure is platy, granular or subangular blocky and soil pH is slightly acid to neutral.

The B horizons have dry color of 10YR 4/3, 5/3; 7.5YR 4/4, 5/4, 6/4, 4/6, 5/6; 5YR 4/4, 5/3 and moist color of 10YR 3/3, 3/4, 4/3, 4/4; 7.5YR 3/4, 4/4, 5/4; 5YR 3/4. Textures are clay loam to clay and increase in clay content with depth. Coarse fragments may make up to 15 percent by volume. Structure is subangular and angular blocky and soil pH is slightly acid to neutral.

Csim horizon is massive and is strongly cemented to indurated, or is platy with 1 or 2 mm thick laminar plates coated with opal or silica 1 to 5 cms apart.

Additional Data: Riverside Lab data sample no. S73 Ca-25-2.

DIVERS FAMILY

The Divers family consists of moderately deep and deep, somewhat excessively drained soils formed in andesite, basalt and geologically recent pumice. Permeability is rapid in the pumice overburden, if present, and moderately rapid below. These soils are on volcanic mountain sideslopes and calderas with 5 to 60 percent slopes on the Medicine Lake Highlands at 6500 to 7600 feet elevation. The annual precipitation is 35 to 45 inches which mostly falls during winter as snow. The mean annual air temperature is 36 to 40°F. The frost free season is 40 to 80 days.

Taxonomic Class: Medial-skeletal, Andic Cryochrepts.

Reference Pedon: Divers family, very gravelly loamy coarse sand on a 45 percent slope with a north aspect at 6900 feet elevation under red fir, western white pine and lodgepole pine forest. The soil was moist in all horizons when described on 8/2/80. (Colors are for dry soils unless otherwise stated.)

01–0 to 0 inches; fir and pine needles.

A11–0 to 3 inches; brown (10YR 5/3) very gravelly loamy coarse sand, very dark grayish brown (10YR 3/2) moist; weak medium plates and weak fine and medium granular structure; loose, non-sticky and non-plastic; 35 percent gravel of which 25 percent are cinder and 10 percent are basalt by volume; common to many very fine and fine and few medium and coarse roots; strongly acid (pH 5.2); weakly smeary; clear smooth boundary.

A12–3 to 11 inches; brown (10YR 5/3) extremely cobbly sandy loam, dark yellowish brown (10YR 3/4) moist; weak fine and medium subangular blocky and weak fine granular structure; soft, loose, non-sticky and non-plastic; 35 percent andesite and basalt cobbles and 30 percent cinder gravel by volume; common to many very fine and fine and common medium and coarse roots; few fine pores; strongly acid (pH 5.4); weakly smeary; grandual wavy boundary.

B1–11 to 28 inches; yellowish brown (10YR 5/4) extremely cobbly sandy loam, brown (10YR 3/4) moist; weak fine and medium subangular blocks and weak fine granular structure; slightly hard, very friable, slightly sticky and non-plastic; 40 percent cobbles, 20 percent stones and 15 percent gravel by volume of andesite and basalt; common very fine, fine, medium and coarse roots; few fine pores; medium acid (pH 5.6); weak to moderately smeary; gradual wavy boundary.

B2–28 to 53 inches; light yellowish brown (10YR 6/4) extremely cobbly sandy loam, dark yellowish brown (10YR 4/4) moist; weak to moderate medium subangular blocky structure; soft, very friable, slightly sticky and non-plastic; very few thin clay films on ped faces and pores; 35 percent andesite and basalt cobbles, 30 percent cinder gravel and 15 percent andesite and basalt gravel, in total 80 percent coarse frgaments by volume; common very fine and fine and few medium and coarse roots; common very fine and fine pores; medium acid (pH 5.6); weak to moderately smeary; clear smooth boundary.

B3si–53 to 60 inches; olive yellow (2.5Y 6/6) extremely cobbly sandy loam, yellowish brown (10YR 5/4) moist; strong medium and coarse platy structure, weakly consolidated silica pan which rubs with hand pressure to sandy loam; very hard, very friable; slightly sticky and non-plastic; 40 percent andesite and basalt cobbles and 35 percent cinders, andesite and basalt gravel by volume; common very fine and fine and few medium pores; medium acid (pH 5.8); weakly smeary.

Reference Pedon Location: Siskiyou County, California, about 30 feet south of road and about 2450 feet south and 1200 feet west of NE corner of Section 9, T.43N., R.3E.

Range in Characteristics: Depth to a lithic contact is greater than 30 inches. Rock fragments average 40 to 80 percent in the control section and are predominately basalt and andesite cobbles and gravel. The mean annual soil temperature at 20 inches is about 38 to 42°F. The soil temperature at the 20 inch depth exceeds 41°F. from July 1 through October 30 and exceeds 47°F. from July 15 through September 25 in most years. The mean summer soil temperature at 20 inches is less than 47°F. The soils 5 to 15 inch moisture control section is usually moist in all parts from November 1 through June 15 and dry in all parts from August 20 through October 10 in most years.

The Divers family commonly has an approximate 900 year old pumice deposit of up to 24 inches in thickness. This deposit is always less than half the thickness of the underlying combined A and B horizons. The pumice overburden, if present, consists of an A, or an A-C horizon development in the deeper deposits. If present, the pumice A horizon has dry color of 10YR 5/1, 5/2, 5/3, 6/2, 6/3 and moist color of 10YR 3/2, 3/3, 3/4, 4/2, 4/3 and may be up to 4 inches thick. Texture is coarse loamy sand or coarse sandy loam and contains from 35 to 60 percent by volume pumice gravel. It is single grained

and soil pH is moderately acid. The pumice overburden C horizon, if present, has dry color of 10YR 7/2, 7/3, 8/2, 8/3 and moist color of 10YR 5/2, 6/2, 6/3, 7/2. Texture is coarse loamy sand or coarse sand and contains from 50 to 90 percent by volume pumice gravel. It is single grained and soil pH is moderately acid.

The loam textured soil beneath the pumice overburden, if present, has an A-B horizon development.

The A horizon is 8 to 13 inches thick and have dry color of 10YR 4/2, 5/2, 5/3, 5/4, 6/3; 7.5YR 6/4 and moist color of 10YR 3/2, 3/3, 3/4, 4/2, 4/3; 7.5YR 3/4, 4/2, 4/4. Texture is loamy sand, coarse sandy loam or sandy loam and contain between 30 to 50 percent by volume cobbles and gravel. Mollic colors do not extend beyond 6 inches from the soil surface. Structure is granular, platy, or subangular blocky and soil pH is strongly acid to medium acid.

The B horizon has dry color of 10YR 5/3, 5/4, 6/4, 6/6; 7.5YR 6/4 and moist color of 10YR 3/4, 4/4, 4/6, 5/4; 7.5YR 4/4. Texture is sandy loam or loamy sand and contain from 40 to 80 percent by volume cobbles, stone and gravel size rock fragments. Structure is subangular blocky and soil pH is strongly acid to medium acid.

DUNCOM FAMILY

The Duncom family consists of shallow, well drained soils which formed from andesite, basalt or tuff. Permeability is moderate. These soils are on 5 to 30 percent slopes and occur on sideslopes, ridges, and knolls of mountain uplands at 7000 to 8000 feet elevation. The climate is cold with a mean annual air temperature of 36 to 40°F. The annual precipitation is 25 to 35 inches and falls mostly as snow in winter. The frost free season is 40 to 70 days.

Taxonomic Class: Loamy, mixed, Lithic Cryoborolls.

Reference Pedon: Duncom family loam on a southwest facing 10 percent slope of a mountain ridge at 7600 feet elevation under big sagebrush, mule ears, phlox sp., lupine and bunchgrass rangeland. Soil was dry when described on 9/17/80. (Colors are for dry soil unless otherwise stated.)

A11–0 to 6 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; weak fine and medium subangular blocky structure which parts into moderate fine granular; slightly hard, very friable, non-sticky and non-plastic; 5 percent gravel by volume; common to many very fine and fine and few medium roots; few very fine and fine pores; neutral (pH 6.6); gradual wavy boundary.

A12–6 to 12 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; weak fine and medium subangular blocky structure; slightly hard, very friable, non-sticky and non-plastic; 5 percent gravel by volume; common very fine, fine and medium and few coarse roots; few very fine and fine pores; slightly acid (pH 6.4); clear smooth boundary.

A13–12 to 17 inches; brown (10YR 4/3) loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium subangular blocky structure; slightly hard, very friable, non-sticky and slightly plastic; 5 to 10 percent gravel by volume; common very fine and fine, few medium and coarse roots; few to common pores; slightly acid (pH 6.4) abrupt smooth boundary.

R–17 plus inches; hard fractured basalt.

Reference Pedon Location: Modoc County, California, about 200 feet east and 1400 feet north of the SW corner of Section 16, T.44N., R.15E.

Range in Characteristics: Depth to a lithic contact is 10 to 20 inches. The mean annual soil temperature at the lithic contact is about 38 to 42°F. and the mean summer temperature at the contact is about 50 to 59°F. The soil temperature at the lithic contact exceeds 41°F. from June 1 through November 15 and exceeds 47°F. from June 15 through October 15 in most years. The 4 to 12 inch soil moisture control section, or to the lithic contact if shallower, is usually moist in all parts from November 1 through June 15 and dry in all parts from August 10 through October 10. Clay content in the control section averages 16 to 24 percent.

The A horizon normally occupies the whole soil depth and have dry color of 10YR 4/2, 4/3, 5/2, 5/3; 7.5YR 4/2, 4/3 and have moist color of 10YR 2/1, 2/2, 3/2, 3/3; 7.5YR 3/2. Texture is loam and contains from 5 to 35 percent by volume rock fragments normally of the cobble and gravel size with some stones. Structure is granular or subangular blocky and soil pH is slightly acid to neutral.

ELMORE FAMILY

The Elmore family consists of deep and moderately deep, well drained soils formed in material weathered from volcanic tuff and basalt. Permeability is moderately slow. These soils are found on basalt plateaus, mountain sideslopes and alluvial fans and draws. Slopes are 1 to 50 percent. Elevations are 4300 to 6000 feet. The annual precipitation is 16 to 25 inches, most of which falls during winter as snow. The mean annual air temperature is 44 to 48°F. The frost free season is 80 to 110 days.

Taxonomic Class: Fine-loamy, mixed, mesic, Pachic Ultic Argixerolls.

Reference Pedon: Elmore family loam on a northwest facing 5 percent undulating basalt plateau at 4800 feet elevation under a ponderosa pine and Jeffrey pine forest. Soil was moist throughout when described on 6/2/78. (Colors are for dry soil unless otherwise stated.)

01–2 to 0 inches; duff layer of ponderosa pine and Jeffrey pine needles and twigs.

A11–0 to 3 inches; dark brown (7.5YR 4/4) loam, dark reddish borwn (5YR 3/2) moist; moderate and weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; many fine and few medium roots; slightly acid (pH 6.4); clear wavy boundary.

A12–3 to 13 inches; reddish brown (5YR 4/4) loam, dark reddish brown (5YR 3/3) moist; weak fine granular structure; very friable, slightly sticky and slightly plastic; common medium coarse and fine roots; many fine and few medium tubular pores; neutral (pH 6.6); gradual wavy boundary.

B21t–13 to 30 inches; dark brown (7.5YR 4/4) gravelly heavy loam, dark reddish brown (5YR 3/3) moist; weak and moderate fine subangular blocky structure; slightly hard, very friable, sticky and slightly plastic; 20 percent by volume basalt gravel; common medium and coarse and many fine roots; common fine tubular pores; neutral (pH 6.6); clear wavy boundary.

B22t–30 to 48 inches; brown (7.5YR 5/4) gravelly clay loam, dark reddish brown (5YR 3/4) moist; weak and moderate fine subanghular blocky structure; slightly hard, friable, sticky and plastic; few to common thin clay films on ped faces; 25 percent gravel by volume; common medium and coarse and many fine roots; common fine pores; neutral (pH 6.6); clear smooth boundary.

IICr–48 to 60 inches; light yellowish brown (10YR 6/4) moist; highly weathered soft vesicular basalt which rubs to a loam texture.

Reference Pedon Location: Modoc County, California, about 30 feet south of Loveness Road and about 1850 feet east and 1300 feet south of NW corner of Section 22, T.42N., R.7E.

Range in Characteristics: Depth to bedrock is generally greater than 40 inches but ranges from 20 to 40 inches in map units 204, 205, 206, 222 and some pedons in map units 166 and 169. The control section averages 22 to 35 percent clay content and coarse fragments range from 5 to 35 percent by volume. Base saturation by the ammonium acetate method is estimated to be between 50 to 75 percent throughout the upper 30 inches of the soil. The mean annual soil temperature at a depth of 20 inches is 47 to 52°F. and fluctuates by more than 9°F. during the year. The soil temperature at the 20 inch depth exceeds 41°F. from April 15 through November 30 and exceeds 47°F. from May 1 through November 1 in most years. The 4 to 12 inch soil moisture control section is usually moist in all parts from December 1 through May 15 and dry in all parts from July 15 through October 30.

The A horizon is 8 to 16 inches thick with dry color of 10YR 4/2, 4/3, 4/4, 5/2; 7.5YR 4/2, 4/4, 5/4; 5YR 3/3, 3/4, 4/4 and moist color of 10YR 2/2, 3/2, 3/3; 7.5YR 3/2; 5YR 2.5/2, 3/2, 3/3. Texture is loam and may contain up to 25 percent by volume gravel. Structure is granular or subangular blocky and soil pH is slightly acid to neutral.

The B horizon makes up the remaining soil and have dry color of 10YR 4/3, 5/3, 5/6, 6/4; 7.5YR 4/2, 4/4, 4/6, 5/4, 5/6; 5YR 4/4, 5/4, 5/6, 6/4 and moist color of 10YR 3/3, 3/4, 4/4, 5/4; 7.5YR 3/2, 3/4, 4/2, 4/4; 5YR 3/2, 3/3, 3/4, 4/4 or 4/6. The upper parts of the argillic B horizon has mollic colors and may include the whole soil depth. Texture is loam or clay loam and contain from 5 to 35 percent by volume gravel and cobbles. Structure is prismatic or subangular blocky and soil pH is slightly acid to neutral.

FORDICE FAMILY

The Fordice family consists of moderately deep, well drained soils that formed from basalt, andesite, or tuff. Permeability is moderately slow. These soils are on basalt plateaus and mountain sideslopes of 1 to 60 percent slope. Where these soils have been mapped on steeper ground they are predominantly on the warmer southeast to westerly exposures. They occur at elevations of 4400 to 6000 feet. The annual precipitation is 16 to 20 inches which mostly falls in the winter as snow. The mean annual air temperature is 44 to 49°F. The frost free season is 80 to 110 days.

Taxonomic Class: Loamy-skeletal, mixed, mesic, Ultic Argixerolls.

Reference Pedon: Fordice family very stony loam on a west facing 20 percent mountain sideslope at 5500 feet elevation under a sparce ponderosa pine and western juniper woodland with big sagebrush, rabbitbrush and bunchgrass understory. Soil was dry throughout when described on 9/15/78. (Colors are for dry soil unless otherwise noted.)

01–1 to 0 inches; ponderosa pine and western juniper needles and grass litter.

A11–0 to 3 inches; dark grayish brown (10YR 4/2) very stony loam, very dark brown (10YR 2/2) moist; weak fine granular structure; soft, very friable, non-sticky and non-plastic; 50 percent rock fragments by volume consisting of stones, cobbles and gravel of basalt; many fine and very fine roots; slightly acid (pH 6.2); abrupt smooth boundary.

A12–3 to 9 inches; grayish brown (10YR 5/2) extremely cobbly loam, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure parting to weak fine granular; soft, friable, slightly sticky and non-plastic; very few thin clay films on ped faces; 60 percent rock fragments by volume consisting of stones, cobbles and gravel of basalt; common very fine and fine and few medium and coarse roots; common very fine and fine tubular pores; slightly acid (pH 6.4); clear wavy boundary.

B21t–9 to 12 inches; brown (10YR 4/3) extremely cobbly clay loam, dark brown (10YR 3/3) moist; weak fine and moderate medium subangular blocky structure; slightly hard, friable, sticky and slightly plastic; few thin clay films on ped faces; 65 percent by volume fragments consisting of stones, cobbles and gravel of basalt; common very fine and fine, few medium and coarse roots; common very fine and fine tubular pores; slightly acid (pH 6.4); gradual smooth boundary.

B22t–12 to 18 inches; brown (7.5YR 5/4) extremely cobbly clay loam, dark brown (10YR 4/3) moist; moderate medium subangular blocky structure; slightly hard, friable, sticky and plastic; common moderately thick clay films on ped faces; 70 percent by volume rock fragments consisting of stones, cobbles and gravel of basalt; common very fine and fine, few medium and coarse roots; common very fine and fine tubular pores; neutral (pH 6.6); gradual smooth boundary.

B23t–18 to 28 inches; brown (7.5YR 5/4) extremely cobbly clay loam, dark brown (7.5YR 3/4) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, sticky and slightly plastic; common moderately thick clay films on ped faces; 70 percent by volume rock fragments consisting of stones, cobbles and gravel of basalt; few very fine, and fine and medium roots; common very fine and fine tubular pores; neutral (pH 6.6); abrupt smooth boundary.

R–28 inches; hard fractured basalt.

Reference Pedon Location: Modoc County, California, about 100 feet west and 1900 feet north of SE corner of Section 15, T.45N., R.14E.

Range of Characteristics: Depth to bedrock is 20 to 40 inches. The control section averages 22 to 35 percent clay content and coarse fragments normally average 50 to 80 percent by volume. Base saturation by the ammonium acetate method is estimated to be between 60 and 75 percent normally throughout the whole soil depth. The mean annual soil temperature at a depth of 20 inches is 47 to 53°F. and fluctuates by more than 9°F. during the year. The soil temperature at the 20 inch depth exceeds 41°F. from April 15 through November 30 and exceeds 47°F. from May 1 through November 1 in most years. The 6 to 18 inch soil moisture control section is usually moist in all parts from December 1 through May 15 and dry in all parts from July 15 through October 30.

The A horizon is 6 to 14 inches thick with dry color of 10YR 4/2, 4/3, 5/2, 5/3; 7.5YR 4/2, 4/4, 5/4; 5YR 4/3, 4/4 and moist color of 10YR 2/2, 3/2, 3/3;

7.5YR 3/2; 5YR 3/2, 3/3. Texture is loam and rock fragment content ranges from 40 to 75 percent by volume. Structure is granular or subangular blocky and soil pH is slightly acid to neutral.

The B horizon makes up the remaining soil and have dry color of 10YR 4/3, 5/3, 5/4; 7.5YR 4/4, 5/4; 5YR 4/3, 4/4, 5/3, 5/4 and moist color of 10YR 3/3, 3/4, 4/3; 7.5YR 3/4; 5YR 3/3, 3/4. The mollic epipedon is 10 to 20 inches thick and commonly includes the upper part of the argillic B horizon. Texture is loam or clay loam and rock fragment content is 50 to 80 percent by volume and normally consists of stone, cobble, and gravel size fragments. Structure is subangular blocky and soil pH is slightly acid to neutral.

FRIANA FAMILY

The Friana family consists of moderately deep to deep, well drained soils which weathered from volcanic tuff. Permeability is slow. These soils are on 30 to 60 percent slopes and occur on lower sideslopes and toeslopes of mountain uplands at 7000 to 8000 feet elevation. The climate is cold with 36 to 40°F. mean annual air temperature. The annual preciptiation is 25 to 30 inches which falls mostly as snow during the winter and the frost free season is 40 to 70 days.

Taxonomic Class: Fine, montmorillonitic, Pachic Argic Cryoborolls.

Reference Pedon: Friana family silty clay loam on a north facing 32 percent lower sideslope at 7450 feet elevation under an open canopy of white fir, lodgepole pine and western white pine forest with big sagebrush and various montaine shrubs, forbs, and grasses. Soil was moist below 17 inches when described on 10/9/80. (Colors are for dry soil unless otherwise stated.)

01–1/2 to 0 inches; Lodgepole pine and white fir needles.

A11–0 to 4 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium subangular blocky structure which parts into moderate fine and medium granular; slightly hard, friable, sticky and plastic; 5 percent gravel; many very fine and fine, common medium roots; many very fine and fine, few medium pores; slightly acid (pH 6.4); gradual wavy boundary.

A12–4 to 11 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine and medium subangular blocky structure; hard, friable, sticky and plastic; few to common moderately thick clay films on ped faces; 5 percent gravel; common very fine, fine and medium, few coarse roots; many very fine, fine and few medium pores; slightly acid (pH 6.2); clear wavy boundary.

B21t–11 to 17 inches; dark grayish brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; moderate to strong fine and medium angular blocky structure; very hard, firm, very sticky and very plastic; common thick clay films on ped faces and pores; common very fine and fine, few medium and coarse roots; common very fine and fine and few medium pores; strongly acid (pH 5.4); gradual wavy boundary.

B22t–17 to 38 inches; dark grayish brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist. Moderate to strong fine and medium angular blocky structure; very hard, firm, very sticky and very plastic; common thick clay films on ped faces and pores; few very fine, fine and medium roots; few very fine and fine pores; strongly acid (pH 5.4); gradual wavy boundary.

B3–38 to 53 inches; brown (7.5YR 5/2) very gravelly silty clay loam, dark brown (7.5YR 4/2) moist; massive; very hard, friable, very sticky and plastic; 45 percent gravel; few very fine and fine roots; few very fine and fine pores; medium acid (pH 5.6); abrupt smooth boundary.

R–53 plus inches; congolmerated tuff.

Reference Pedon Location: Modoc County, California, about 800 feet west and 2200 feet north of the SE corner, Section 10, T.47N., R.15E.

Range of Characteristics: Depth to a lithic contact of hard conglomerated volcanic tuff is greater than 30 inches. The mean annual soil temperature at the 20 inch depth is about 38 to 42°F. The soil temperature at the 20 inch depth exceeds 41°F. from July 1 through October 30 and exceeds 47°F. from July 20 through September 20 in most years, however, the mean summer soil temperature at 20 inches is less than 47°F. The 4 to 12 inch soil moisture control section is usually moist in all parts from November 1 through June 15 and dry in all parts from August 15 through October 10. The control section averages 35 to 50 percent clay and may contain up to 15 percent by volume coarse fragments.

The A horizon is 7 to 15 inches thick with dry color of 10YR 4/2, 4/3, 4/4, 5/3 and moist color of 10YR 2/2, 3/2, 3/3. Texture is clay loam or silty clay loam. Structure is granular or subangular blocky and soil pH is moderately acid to neutral.

The B horizon normally makes up the rest of the soil with dry color of 10YR 4/2, 4/3, 4/4, 5/3, 6/3; 7.5YR 4/4, 5/2, 5/4, and moist color of 10YR 3/2, 3/3, 4/2, 4/4; 7.5YR 3/2, 3/34 or 4/2. The upper parts and often the whole B horizon is mollic in color. Texture is silty clay loam, silty clay or clay. Structure is blocky or massive and soil pH is strongly acid to slightly acid. Coarse fragments range from 0 to 50 percent by volume and tend to be more numerous with increased depth.

GALLATIN FAMILY

The Gallatin family consists of moderately deep, well drained soils weathered from basalt and andesite. Permeability is moderate. These soils are on mountain sideslopes of 5 to 50 percent slopes. They occur at elevations of 7000 to 9000 feet. The annual precipitation is 25 to 35 inches which mostly falls during the winter as snow. The mean annual air temperature is 34 to 40°F. The frost-free season is less than 30 to 70 days.

Taxonomic Class: Fine-loamy, mixed, Pachic Cryoborolls.

Reference Pedon: Gallatin family loam on a north facing 9 percent mountain sideslope at 7100 feet elevation under big sagebrush, mule ears, arrowleaf balsomroot and bunchgrass rangeland with scattered ponderosa pine, white fir and western juniper. Soil was dry below 9 inches when described on 8/30/79. (Colors are for dry soil unless otherwise noted.)

A11–0 to 16 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium subangular blocky structure which parts into weak to moderate very fine and fine granular; slightly hard, friable, slightly sticky and non-plastic; 5 percent gravel by volume; many very fine and fine, and common medium roots; few fine and medium pores; slightly acid (pH 6.4); gradual wavy boundary.

A12–16 to 21 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak to moderate medium and coarse subangular blocky structure which parts into moderate very fine and fine granular; slightly hard, very friable, slightly sticky and slightly plastic; 5 to 10 percent gravel by volume; common very fine and fine, and few medium roots; common very fine and fine and few medium pores; slightly acid (pH 6/2); clear wavy boundary.

A13–21 to 29 inches; dark grayish brown (10YR 4/2) very cobbly loam, very dark grayish brown (10YR 3/2) moist; weak to moderate medium and coarse subangular blocky structure which parts into moderate fine and medium granular; slightly hard, friable, slightly sticky and slightly plastic; 50 percent basalt cobbles and stones by volume; common very fine and fine, and few medium roots; common very fine and fine and few medium pores; slightly acid (pH 6/4); abrupt wavy boundary.

R–29 plus inches; hard fractured basalt.

Reference Pedon Location: Modoc County, California, about 200 feet south of road and about 750 feet west and 2000 feet south of the NE corner of Section 27, T.39N., R.15E.

Range in Characteristics: Depth to a lithic contact is 20 to 40 inches. The mean annual soil temperature at the 20 inch depth is about 36 to 42°F. and the mean summer temperature is about 50 to 59°F. The soil temperature at 20 inches exceeds 41°F. from June 1 through November 15 and exceeds 47°F. from June 15 through October 15 in most years. The 4 to 12 inch soil moisture control section is usually moist in all parts from November 1 through June 15 and dry in all parts from August 10 through October 10. Clay content in the control section averages 18 to 27 percent, and rock fragments average 10 to 35 percent by volume.

The A horizon normally occupies the whole soil depth and have dry color of 10YR 4/2, 4/3, 4/4, 5/2, 5/3; 7.5YR 4/2, 4/4 and have moist color of 10YR 2/2, 3/2, 3/3; 7.5YR 3/2. Texture is loam or light clay loam and contains from 5 to 50 percent by volume rock fragments normally of the cobble and gravel size with some stones. Structure is granular or subangular blocky and soil pH is slightly acid to neutral.

GERMANY FAMILY

The Germany family consists of moderately deep and deep, well drained soils formed in material weathered from volcanic ash and basalt. Permeability is moderately rapid. These soils are found on basalt plateaus. Slopes range from 1 to 5 percent. Elevations are 4300 to 5000 feet. The annual precipitation ranges from 18 to 28 inches, most of which falls during winter as snow. The mean annual air temperature is 44 to 48°F. The frost free season is 80 to 110 days.

Taxonomic Class: Medial, mesic, Andic Xerumbrepts.

Reference Pedon: Germany family fine sandy loam on a nearly level basalt plateau among reef-like formations of lava flow rock at 4300 feet elevation under an open ponderosa pine forest with greenleaf manzanita, rabbitbrush, bitterbrush, big sagebrush and bunchgrass understory. Soil was moist to 14 inches when described on 10/17/79. (Colors are for dry soil unless otherwise stated.)

01–1 to 0 inches; ponderosa pine needles and twigs.

A11–0 to 6 inches; dark yellowish brown (10YR 4/4) fine sandy loam, dark brown (7.5YR 3/2) moist; weak fine and medium platy structure which parts into moderate fine granular; soft, very friable, slightly sticky and non-plastic; 5 percent gravel by volume; many very fine and fine, common medium roots; common fine pores; slightly acid (pH 6.2); clear wavy boundary.

A12–6 to 14 inches; yellowish brown (10YR 5/4) fine sandy loam, dark brown (10YR 3/3) moist; weak medium and coarse subangular blocky structure; soft, very friable, slightly sticky and non-plastic; 5 percent gravel and 5 percent cobbles by volume; many very fine and fine, common medium and few coarse roots; common fine and medium pores; slightly acid (pH 6.2); gradual wavy boundary.

B2–14 to 32 inches; yellowish brown (10YR 5/4) cobbly fine sandy loam, dark yellowish brown (10YR 3/4) moist; weak medium and coarse subangular blocky structure; slightly hard, very friable, slightly sticky and non-plastic; 10 percent cobbles and 5 percent gravel by volume; many very fine and fine, common medium and coarse roots; common very fine and fine, few medium pores; medium acid (pH 6.0); clear wavy boundary.

C–32 to 47 inches; brownish yellow (10YR 6/6) very cobbly fine sandy loam, strong brown (7.5YR 5/6) moist; massive; very friable, soft, slightly sticky and non-plastic; 20 percent cobbles and 20 percent gravel by volume; many medium, common very fine, fine and coarse roots; common very fine and fine and few medium pores; medium acid (pH 6.0); abrupt wavy boundary.

R–47 plus inches; fractured hard vesicular basalt.

Reference Pedon Location: Modoc County, California, about 40 feet south of road and about 2300 feet west and 1100 feet north of SE corner of Section 11, T.41N., R.5E.

Range in Characteristics: Depth to a lithic contact is normally 20 to 40 inches in soil map unit 174, and greater than 40 inches in map unit 173. The mean annual soil temperature at a depth of 20 inches is about 47 to 52°F. and fluctuates by more than 9°F. during the year. The soil temperature at 20 inches exceeds 41°F. from April 15 through November 30 and exceeds 47°F. from May 1 through November 1 in most years. The 4 to 12 inch soil moisture control section is usually moist in all parts from December 1 through May 15 and dry in all parts from July 15 through October 30. Base saturation by the ammonium acetate method is 25 to 50 percent in most or all parts of the epipedon and remainder of the soil. The soil bulk density in the upper 14 inches or so of soil is 0.90 to 1.00 gm/cm^{3}at 1/3 bar water tension and the ratio of measured clay to 15 bar water is less than 1.25. NaF pH is normally greater than 10. Rock fragments in the control section average 10 to 35 percent by volume.

The A horizon is 8 to 20 inches thick with dry color of 10YR 4/4, 5/4; 7.5YR 4/4, 4/6; 5YR 4/4 and moist color of 10YR 3/2, 3/3; 7.5YR 3/2; 5YR 3/3. Texture is sandy loam or fine sandy loam and is weakly to moderately smeary in consistance. Rock fragments average 5 to 20 percent by volume. Structure is platy, granular or subangular blocky and soil pH is medium to slightly acid.

The B horizon has dry color of 10YR 5/4, 5/6, 6/4; 7.5YR 5/4 and moist color of 10YR 3/4, 4/3, 4/4, 4/6; 7.5YR 3/4; 5YR 3/4. Texture is sandy loam, fine sandy loam or loam and rock fragments range from 10 to 50 percent by volume and increase with depth. Structure

is subangular blocky and soil pH is medium to slightly acid.

The C horizon, if present, has dry color of 10YR 6/4, 6/6, 7/3, 7/4 and moist color of 10YR 5/3, 5/4, 5/6; 7.5YR 5/4, 5/6. Texture is sandy loam or fine sandy loam and contains from 35 to 60 percent by volume rock fragments. Structure is massive and soil pH is medium to slightly acid.

Additional Data: Lincoln Lab. Sample #S79Ca-049-013.

GINSER FAMILY

The Ginser family consists of moderately deep, well drained soils that have formed from basalt or andesite. Permeability is moderate. These soils are on 20 to 40 percent slopes and occur on sideslopes of mountain uplands at 5500 to 7000 feet elevation. The climate is cool with 42 to 46°F. mean annual air temperature and annual precipitation of 20 to 22 inches which mostly falls as snow during winter. The frost free season is 60 to 90 days.

Taxonomic Class: Loamy-skeletal, mixed, frigid, Pachic Haploxerolls.

Reference Pedon: Ginser family cobbly loam, on a south facing 37 percent mountain sideslope at 6400 feet elevation under a predominately big sagebrush, mule ears and Idaho fescue rangeland with scattered ponderosa pine and white fir. (Colors are for dry soil unless otherwise stated.)

A11–0 to 3 inches; dark brown (10YR 4/3) cobbly loam, very dark brown (10YR 2/2) moist; moderate medium and coarse granular structure; slightly hard, very friable, sticky and slightly plastic; 15 percent cobbles and stones and 15 percent gravel by volume; many very fine and fine and common medium roots; slightly acid (pH 6.4); clear smooth boundary.

A12–3 to 12 inches; dark brown (10YR 4/3) very cobbly loam, very dark brown (10YR 2/2) moist; moderate fine subangular blocky structure; slightly hard, friable, sticky and slightly plastic; 25 percent cobbles and 20 percent gravel by volume; many very fine and fine and common medium roots; common very fine and fine pores; neutral (pH 6.6); gradual wavy boundary.

A13–12 to 24 inches; dark yellowish brown (10YR 4/4) extremely cobbly loam, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure; hard, friable, sticky and plastic; very few thin clay films on ped faces; 35 percent cobbles and 25 percent gravel by volume; common to many very fine and fine and few medium roots; common very fine and fine and few medium pores; neutral (pH 6.8); abrupt wavy boundary.

R–24 plus inches; hard, moderately weathered vesicular basalt.

Reference Pedon Location: Modoc County, California, about 30 feet north of road and about 1300 feet east and 900 feet north of the SW corner of Section 25, T.45N., R.14E.

Range in Characteristics: Depth to a lithic contact of fractured basalt or andesite is 20 to 40 inches. The mean annual soil temperature at the 20 inch depth is about 44 to 47°F. and fluctuates by more than 9°F. during the year. The soil temperature at 20 inches exceeds 41°F. from May 15 through November 15 and exceeds 47°F. from June 15 through October 15 in most years. The 5 to 15 inch soil moisture control section is usually moist in all parts from November 20 through May 15, and dry in all parts from July 20 through October 20. The average rock fragment content of the control section is 35 to 60 percent by volume, and also averages 18 to 25 percent clay.

The A horizon normally occupies the whole soil depth and have dry color of 7.5YR 4/2, 4/3; 10YR 4/2, 5/3, 5/4 and moist color of 7.5YR 3/2; 10YR 2/2, 3/2 or 3/3. Texture is loam and contains from 35 to 60 percent by volume rock fragments consisting mainly of gravels, cobbles and stones. Structure is granular and subangular blocky and soil pH is slightly acid to neutral.

GLEASON FAMILY

The Gleason family consists of deep, well drained soils formed from tuff, andesite, or obsidian. Permeability is moderately rapid. These soils are on 10 to 40 percent slopes and occur on rolling foothills and sideslopes of mountain uplands at 4800 to 6200 feet elevation. The climate is cool and dry in summer with 40 to 46°F. mean annual air temperature and 16 to 25 inches annual precipitation which mostly falls as snow during the winter. Frost free season is 70 to 90 days.

Taxonomic Class: Coarse-loamy, mixed, frigid, Entic Haploxerolls.

Reference Pedon: Gleason family gravelly sandy loam on a rolling foothill under a ponderosa pine forest with bitterbrush, big sagebrush and squaw carpet understory. (Colors are for dry soil unless otherwise stated.)

01–1 to 0 inches; litter of ponderosa pine needles.

A11–0 to 4 inches; grayish brown (10YR 5/2) gravelly sandy loam, dark grayish brown (10YR 3/2) moist; moderate very fine granular structure; loose, very friable, non-sticky, non-plastic; many very fine roots; many very fine interstitial pores; 30 to 35 percent by volume obsidian gravel; slightly acid (pH 6.5); clear smooth boundary.

A12–4 to 16 inches; grayish brown (10YR 5/2) sandy loam, very dark grayish brown (10YR 3/2) moist; massive; soft, very friable, non-sticky, non-plastic; common very fine roots; many very fine interstitial and tubular pores; less than 10 percent by volume obsidian gravel; medium acid (pH 6.0); clear wavy boundary.

C–16 to 22 inches; grayish brown (10YR 5/2) sandy loam, dark yellowish brown (10YR 3/4) moist; massive; slightly hard, very friable, non-sticky, non-plastic; few very fine and fine, common medium and few coarse roots; many very fine interstitial and common very fine tubular pores; less than 10 percent by volume obsidian gravel; medium acid (pH 6.0); gradual wavy boundary.

C1–22 to 35 inches; light gray (10YR 7/2) gravelly sandy loam, brown (10YR 5/3) moist; massive; slightly hard, friable, non-sticky, non-plastic; few fine roots, common coarse roots; many very fine interstitial pores; 15 percent gravel by volume; slightly acid (pH 6.2); gradual smooth boundary.

C2–35 to 50 inches; very pale brown (10YR 7/3) very gravelly coarse sand, light yellowish brown (10YR 6/4) moist; massive; slightly hard, very friable, non-sticky, non-plastic; few fine roots; few very fine interstitial pores; 50 percent gravel by volume of weathered tuff; slightly acid (pH 6.2); gradual smooth boundary.

R–50 plus inches; pale brown (10YR 6/3) hard tuff agglomerate.

Reference Pedon Location: Modoc County, California; about 8 miles north of Davis Creek; 30 feet south and 90 feet west of the east quarter corner of Section 10, T.46N., R.14E. (State Model).

Range in Characteristics: Depth to a lithic contact is greater than 40 inches. The mean annual soil temperature at a depth of 20 inches is 43 to 47°F. and fluctuates by more than 9°F. during the year. The soil temperature at the 20 inch depth exceeds 41°F. from June 15 through October 15 in most years. The 6 to 18 inch soil moisture control section is usually moist in all parts from November 15 through May 30 and dry in all parts from August 1 through October 20. The coarse fragment content of the control section averages 10 to 35 percent by volume and clay content averages 12 to 18 percent.

The A horizon is 12 to 20 inches thick with dry color of 10YR 4/3, 5/2, 5/3, 5/4 and moist color of 10YR 3/2, 3/3 or 7.5YR 3/2. Texture is sandy loam or fine sandy loam and contains from 15 to 45 percent by volume coarse fragments. Structure is granular or massive and soil pH is medium to slightly acid.

The C horizon occupies the remainder of the soil with dry color of 10YR 6/3, 6/4, 7/2, 7/3, 7/4 and moist color of 10YR 5/2, 5/3, 5/4, 6/3, 6/4. Texture is sandy loam, loamy sand or coarse sand, normally becoming sandier with depth. Coarse fragments average 10 to 60 percent and becomes more numerous with depth. It is massive to single grained and soil pH is medium acid to slightly acid.

Additional Data: Riverside Lab pedon no. S72 Calif. 25-12.

GRALIC FAMILY

The Gralic family consists of moderately deep and deep, well drained soils that formed in andesite and obsidian. Permeability is moderately rapid. These soils are on 10 to 65 percent slopes and occur on smooth and convex mountain sideslopes at 7000 to 8000 feet elevation. The annual precipitation is 25 to 30 inches which mostly falls as snow during the winter. The mean annual air temperature is 36 to 40°F. The frost free season is 40 to 70 days.

Taxonomic Class: Loamy-skeletal, mixed, non-acid, Typic Cryorthents.

Reference Pedon: Gralic family very gravelly fine sandy loam on a 28 percent southwest facing upper sideslope at 7440 feet elevation under lodgepole pine, western white pine and Washoe pine forest with an understory of prostrate manzanita and ceanothus. Soil was moist below 17 inches when described on 9/17/80. (Colors are for dry soils unless otherwise stated.)

01–1 to 0 inches; lodgepole pine needles and twigs.

1–0 to 4 inches; grayish brown (10YR 5/2) very gravelly fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, loose, non-sticky and non-plastic; 40 percent gravel by volume; common very fine, fine, medium and coarse root; slightly acid (pH 6.2); smooth boundary.

AC–4 to 17 inches; pale brown (10YR 6/3) very gravelly fine sandy loam, brown (10YR 4/3) moist; weak fine and medium granular structure; soft, loose, non-sticky and non-plastic; 45 percent gravel by volume; common, very fine, fine, medium and coarse roots; slightly acid (pH 6.2); gradual wavy boundary.

C1–17 to 33 inches; light yellowish brown (10YR 6/4) very gravelly sandy loam, brown (10YR 5/3) moist; single grain with some weak fine granular structure; loose, non-sticky and non-plastic; 60 percent gravel by volume; few to common very fine and fine, few medium and coarse roots; slightly acid (pH 6.2); clear smooth boundary.

C2–33 to 42 inches; very pale brown (10YR 7/3) very gravelly sandy loam, pale brown (10YR 6/3) moist; single grain structure; loose, non-sticky and non-plastic; 45 percent weathered obsidian gravel by volume; slightly acid (pH 6.4); clear smooth boundary.

C3–42 to 60 inches; very pale brown (10YR 7/3) very gravelly loamy sand, pale brown (10YR 6/3) moist; massive; soft, loose; non-sticky and non-plastic; 40 percent weathered obisdian gravel by volume; few very fine roots; slightly acid (pH 6.4).

Reference Pedon Location: Modoc County, California, about 30 feet above road and about 250 feet east and 1800 feet south of NW corner of Section 33, T.45N., R.15E.

Range in Characteristics: Depth to weathered tuff, cinders, obsidian or andesite bedrock is greater than 30 inches. Clay content in the control section averages 8 to 15 percent and coarse fragments average 35 to 60 percent by volume. The mean annual soil temperature at the 20 inch depth is about 38 to 42°F. The soil temperature at 20 inches exceeds 41°F. from July 1 through October 30 and exceeds 47°F. from July 20 through September 20 in most years. The mean summer soil temperature at 20 inches is less than 47°F. The 5 to 15 inch soil moisture control section is usually moist in all parts from November 1 through June 15 and dry in all parts from August 15 through October 10.

The A horizon is 3 to 6 inches thick with dry color of 10YR 5/2, 5/3, 5/4, 6/2 and moist color of 10YR 3/2, 3/3, 3/4, 4/2. Texture is fine sandy loam or sandy loam and contains from 20 to 50 percent by volume coarse fragments. Structure is granular and soil pH is slightly acid to neutral.

The C horizon makes up the remainder of the soil with dry color of 10YR 6/2, 6/3, 7/2, 7/3, 7/4 and moist color of 10YR 4/2, 4/3, 5/2, 5/3, 5/4, 6/2, 6/3. Texture is fine sandy loam, sandy loam or loamy sand and contains from 35 to 60 percent by volume coarse fragments. Structure is massive or single grained and soil pH is slightly acid to neutral.

GWIN FAMILY

The Gwin family consists of shallow, well drained soils that formed from material derived from basalt, andesite or tuff. Permeability is moderately slow. These soils are on basalt plateaus or mountain sideslopes with 2 to 70 percent slopes and mainly on southerly to westerly aspects at 4200 to 6400 feet elevation. The climate is warm with 44 to 50°F. mean annual air temperature and annual precipitation of 10 to 20 inches, most of which falls during winter as snow. Frost free season is 80 to 110 days.

Taxonomic Class: Loamy-skeletal, mixed, mesic, Lithic Argixerolls.

Reference Pedon: Gwin family, very cobbly loam on an 8 percent southwest exposure on an undulating basalt plateau at 4700 feet elevation under western juniper, big sagebrush, bitterbrush, and bunchgrass rangeland. (Colors are for dry soils unless otherwise stated.)

A11–0 to 7 inches; dark grayish brown (10YR 4/2) very cobbly loam, very dark brown (10YR 2/2) moist; weak fine and medium subangular blocky structure which parts into weak to moderate fine and medium granular; slightly hard, very friable, slightly sticky and slightly plastic; 30 percent gravel and 25 percent cobbles by volume; common very fine, fine and medium and few coarse roots; common very fine and fine pores; neutral (pH 6.8); gradual wavy boundary.

A12–7 to 11 inches; dark grayish brown (10YR 4/2) very cobbly loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium subangular blocky structure which parts into moderate fine and medium granular; slightly hard, very friable; slightly sticky and slightly plastic; 35 percent cobbles and 20 percent gravel by volume; few to common fine and medium and few coarse roots; few very fine and fine pores; neutral (pH 6.8); clear wavy boundary.

B2t–11 to 18 inches; brown (10YR 4/3) extremely cobbly clay loam, dark brown (10YR 3/3) moist; moderate fine and medium subangular blocky structure; hard, friable, sticky and plastic; few to common thin clay films on pores and ped faces; 40 percent cobbles and 30 percent gravel by volume; few fine, medium and coarse roots; few very fine, fine and medium pores; neutral (pH 7.0); abrupt wavy boundary.

R–18 plus inches; hard fractured vesicular basalt.

Reference Pedon Location: Siskiyou County, California, about 1300 feet south and 2300 feet west of the NE corner of Section 20, T.45N., R.4E.

Range in Characteristics: Depth to the lithic contact ranges from 8 to 20 inches. The mean annual soil temperature at the lithic contact is about 47 to 53°F. and fluctuates by more than 9°F. during the year. The soil temperature at the lithic contact exceeds 41°F. from April 1 through December 1. Where this soil is mapped in map unit 247 the soil between depths of about 5 to 15 inches, or lithic contact if shallower, is usually dry in all parts from June 15 through November 15, and moist in all parts from December 15 through May 1. Where this soil is mapped with other units the soil at the 5 to 15 inch depth, or lithic contact if shallower, is usually dry in all parts from July 1 through October 30, and moist in all parts from December 1 through May 1. The average rock fragment content of the control section is 35 to 75 percent by volume and clay content averages 20 to 35 percent.

The A horizon is 3 to 11 inches thick with dry color of 10YR 4/2, 4/3, 5/2, /5/3, 5/4; 7.5YR 4/2, 4/4, 5/4 and moist color of 10YR 2/2, 3/2, 3/3; 7.5YR 3/2. Texture is loam or sandy loam and contains from 25 to 65 percent by volume rock fragments. Structure is granular or subangular blocky and soil pH is neutral to slightly acid.

The B horizon has dry color of 10YR 4/3, 4/4, 5/3, 5/4; 7.5YR 4/4, 5/4, and moist color of 10YR 3/2, 3/3, 3/4, 4/2, 4/3; 7.5YR 3/2, 3/4, 4/4. The upper 7 inches of soil and often the whole soil depth is mollic in color. Texture is loam or clay loam and contains from 35 to 75 percent by volume rock fragments. Structure is subangular blocky and soil pH is neutral.

HADES FAMILY

The Hades family consists of moderately deep, well drained soils that formed from basalt and andesite. Permeability is moderately slow. These soils are on 10 to 25 percent slopes and occur on lower sideslopes and alluvial fans in mountain uplands at 5700 to 6500 feet elevation. The climate is cool with 42 to 46°F mean annual air temperature and annual precipitation of 20 to 22 inches. Frost free season is 60 to 90 days.

Taxonomic Class: Fine-loamy, mixed, frigid, Pachic Argixerolls.

Reference Pedon: Hades family loam, on a 14 percent east facing mountain sideslope at 6480 feet elevation under big sagebrush, rabbitbrush, mountain mahogany, squawcarpet, Ceanothus, mule ears, wheat grass and Idaho fescue transitional rangeland with a few scattered encroaching ponderosa pine. Soil was moist in all horizons when described on 11/4/81. (Colors are for dry soil unless otherwise stated).

A11–0 to 6 inches; dark brown (7.5YR 4/2) loam, very dark brown (10YR 2/2) moist; moderate very fine and fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; 5 percent gravel by volume; many very fine, common fine and medium and few coarse roots; neutral (pH 6.6); gradual wavy boundary.

A12–6 to 15 inches; dark brown (7.5YR 4/2) loam, very dark brown (10YR 2/2) moist; weak medium subangular blocky structure which parts into moderate fine and medium granular; slightly hard, very friable, slightly sticky and slightly plastic; 5 to 10 percent gravel by volume; moderate fine, very fine, and medium and few coarse roots; few to common very fine, fine and coarse pores; neutral (pH 6.8); clear smooth boundary.

B21t–15 to 22 inches; brown (10YR 4/3) gravelly clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure; slightly hard, friable, sticky and plastic; 10 to 15 percent gravel and 5 percent cobbles by volume; few moderately thin clay films on ped faces and pores; common very fine and fine, and few to common medium and coarse roots; common very fine and fine and few coarse pores; neutral (pH 6.8); gradual wavy boundary.

B22t–22 to 36 inches; brown (10YR 4/3) gravelly silty clay loam, dark brown (10YR 3/3) moist; moderate medium subangular blocky structure; hard, friable, sticky and plastic; common moderately thick clay films on ped faces and pores; 25 percent gravel by volume; few very fine, fine, medium and coarse roots; few to common very fine, fine and coarse pores; neutral (pH 6.8); abrupt wavy boundary.

R–36 plus inches; hard fractured basalt, with some soil between fractures.

Reference Pedon Location: Lassen County, California, about 300 feet east and 1800 feet south of the NW corner of Section 11, T.38N., R.11E.

Range in Characteristics: Depth to a lithic contact of fractured basalt or andesite is 20 to 40 inches. The mean annual soil temperature at a depth of 20 inches is about 44 to 47° F. and fluctuates by more the 9°F. during the year. The soil temperature at the 20 inch depth exceeds 41°F. from May 15 through November 15 and exceeds 47°F. from June 15 through October 15 in most years. The 4 to 12 inch soil moisture control section is usually moist in all parts from November 20 through May 15, and dry in all parts from July 20 through October 20. The average coarse fragment contact of the control section is 5 to 35 percent by volume, and also averages 24 to 35 percent clay.

The A horizon is 12 to 20 inches thick with dry color of 10YR 4/2, 4/3, 5/2, 5/3; 7.5YR 4/2, 4/4 and moist color of 10YR 2/2, 3/2. 3/3; 7.5YR 3/2. Texture is loam and may contain up to 20 percent by volume coarse fragments in some pedons. Structure is granular to subangular blocky and soil pH is neutral to slightly acid.

The B horizon makes up the remainder of the soil depth with dry color of 10YR 4/2, 4/3, 4/4, 5/3, 5/4; 7.5YR 4/4, 5/4 and moist color of 10YR 3/2, 3/3, 3/4; 7.5YR 3/2, 3/4. The upper parts of the argillic B horizon has mollic colors and may include the whole soil depth. Texture is loam, clay loam or silty clay loam and contains from 5 to 35 percent by volume coarse fragments. Structure is subangular blocky or prismatic and soil pH is netural.

HIIBNER FAMILY

The Hiibner family consists of moderately deep, well drained soils formed in material weathered from basalt and tuff. Permeability is slow. These soils are on mountain sideslopes of 1 to 60 percent slope and are commonly on southeast to west aspects, and occur at elevations of 4400 to 5800 feet. The climate is cool. The annual precipitation is 14 to 20 inches, most of which falls during the winter as snow. The mean annual air temperature is 44 to 50F. Frost free season is 80 to 110 days.

Taxonomic Class: Clayey-skeletal, montmorillonitic mesic, Typic Argixerolls.

Reference Pedon: Hiibner family stony loam on a 21 percent south facing mountain sideslope at 4500 feet elevation under scattered ponderosa pine, mountain mahogany and western juniper with mulesear and bunchgrass understory. Soil was moist throughout when described on 5/11/79. (Colors are for dry soil unless otherwise noted.)

A11–0 to 3 inches; brown (10YR 4/3) stony loam, very dark brown (10YR 2/2) moist; weak fine granular structure; slightly hard, friable, sticky and slightly plastic; 25 percent stones and cobbles by volume; many very fine and fine roots; neutral (pH 6.6); clear smooth boundary.

A12–3 to 12 inches; brown (10YR 4/3) very cobbly clay loam, very dark grayish brown (10YR 3/2) moist; weak to moderate fine subangular blocky structure which parts to moderate fine and medium granular; slightly hard, friable, sticky and plastic; 35 percent cobbles and stones by volume; common very fine, fine medium and coarse roots; neutral (pH 6.6); clear smooth boundary.

B21t–12 to 21 inches; brown (7.5YR 4/4) very cobbly clay, dark brown (7.5YR 3/4) moist; moderate to strong fine and medium subangular blocky structure; hard, firm, very sticky and very plastic; common moderately thick clay films on ped faces; 40 percent cobbles and stones by colume; common very fine and fine and few medium roots; neutral (pH 6.8); clear smooth boundary.

B22t–21 to 25 inches; brown (7.5YR 4/4) very cobbly clay, dark brown (7.5YR 3/4) moist; moderate to strong fine and medium subangular blocky structure; hard, firm, very sticky and very plastic; common moderately thick clay films on ped faces; 25 percent gravel and 20 percent cobbles by volume; common very fine and fine roots; neutral (pH 6.8); abrupt smooth boundary.

R–25 plus inches; slightly weathered fractured basalt.

Reference Pedon Location: Modoc County, California, about 40 feet south of road and about 2400 feet west and 1300 south of the NE corner of Section 18, T.41N., R.9E.

Range in Characteristics: Depth to a lithic contact of basalt, andesite or volcanic tuff is 20 to 40 inches. Clay content in the control section averages 35 to 60 percent and rock fragments occupy 35 to 70 percent by volume. The mean annual soil temperature at 20 inches is about 47 to 53°F. and flucturates by more then 9°F. during the year. The soil temperature at the 20 inch depth exceeds 41°F. from April 1 through December 1. The 5 to 15 inch soil moisture control section is usually dry in all parts from July 1 through October 30, and moist in all parts from December 1 through May 1.

The A horizon is 8 to 14 inches thick and have dry color of 10YR 4/2, 4/3, 5/3 and moist color of 10YR 2/2, 3/2, 3/3. Texture is loam or clay loam and contains 25 to 60 percent by volume rock fragments. Structure is granular or subangular blocky and soil pH is neutral to slightly acid.

The B horizon makes up the remainder of the soil with dry color of 10YR 4/2, 4/3, 4/4, 5/3, 5/4; 7/5YR 4/4, 5/4 and moist color of 10YR 3/3, 3/4, 4/2, 4/3; 7.5YR 3/4. The mollic epipedon is 10 to 20 inches thick and commonly includes the upper part of the argillic B horizon. Texture is clay loam or clay and contain 35 to 70 percent by volume rock fragments. Structure is subangular or angular blocky and soil pH is neutral to slightly acid.

HOLLAND FAMILY

The Holland family consists of deep and moderately deep, well drained soils that formed in material weathered from volcanic ash and basalt with a recent pumice overburden layer. Permeability is rapid in the pumice overburden to moderately slow below. These soils are on basalt plateaus or on basalt plateau scarp breaks. Elevation ranges from 4200 to 4700 feet. Slopes range from 1 to 40 percent. The annual precipitation is 16 to 20 inches most of which falls during the winter as snow. The mean annual air temperature is 46°F. The frost free season is 90 to 110 days.

Taxonomic Class: Fine-loamy, mixed, mesic, Ultic Haploxeralfs.

Reference Pedon: Holland family (pumice overburden) gravelly loamy coarse sand on a nearly level basalt plateau at 4200 feet elevation under an open canopy of ponderosa pine and Jeffrey pine with bitterbrush and big sagebrush understory. Soil was dry in all parts when described on 10/10/78. (Colors are for dry soil unless otherwise stated.)

01–1/2 to 0 inches; Ponderosa and Jeffrey pine needles.

A1–0 to 6 inches; grayish brown (10YR 5/2) gravelly loamy coarse sand, very dark grayish brown (10YR 3/2) moist; single grained; loose, non-sticky, nonplastic; pumice gravel 30 percent by volume; many fine, very fine and few to common medium roots; neutral (pH 6.6); clear smooth boundary.

C1–6 to 11 inches; very pale brown (10YR 8/3) extremely gravelly coarse sand, very pale brown (10YR 7/3)moist; single grained; loose, non-sticky and nonplastic; pumice gravel 70 percent by volume; common to many fine and very fine and few medium and coarse roots; neutral (pH 6.7); abrupt smooth boundary.

IIA1b–11 to 17 inches; yellowish brown (10YR 5/4) heavy loam, dark yellowish brown (10YR 3/4) moist; weak to moderate fine and medium subangular blocky structure parting to moderate fine and very fine granular; hard, friable, sticky and slightly plastic; gravel 10 percent by volume; common fine and very fine, few medium and coarse roots; many fine and very fine and few medium pores; neutral (pH 6.6); clear smooth boundary.

IIB21tb–17 to 28 inches; yellowish brown (10YR 5/4) clay loam, dark yellowish brown (10YR 3/4) moist; moderate to strong fine and medium subangular blocky and angular blocky structure; hard, friable, sticky and plastic; gravel 2 to 5 percent by volume; few to common fine and very fine, few medium and coarse roots; many fine and very fine, few medium and coarse pores; neutral (pH 6.8); common thin clay films on ped faces; clear smooth boundary.

IIB22tb–28 to 38 inches; brownish yellow (10YR 6/6) clay loam, dark yellowish brown (10YR 4/6) moist; moderate to strong, fine and medium angular and subangular blocky structure; hard, friable, sticky and plastic; common thin clay films on ped faces; gravel 2 to 5 percent by volume; few to common fine, very fine and few medium and coarse roots; many fine and very fine and few medium pores; neutral (pH 6.8); clear wavy boundary.

IIB3tb–38 to 48 inches; brownish yellow (10YR 6/6) gravelly light clay loam, dark yellowish brown (10YR 4/4) moist; moderate fine to medium subangular blocky structure; hard, friable, sticky and slightly plastic; few thin clay films on ped faces; gravel 20 percent by volume; few fine, very fine, medium and coarse roots; many fine, very fine and few medium pores; neutral (pH 6.8); abrupt smooth boundary.

IIR–48 inches; hard basalt.

Reference Pedon Location: Modoc County, California, about 300 feet north of road and about 1900 feet west and 1600 feet north of the SE corner of Section 24, T.44N., R.5E.

Range in Characteristics: Depth to a lithic contact is 20 to 40 inches in soil map units 182 and 246 and greater than 40 inches in map unit 183. The control section averages 24 to 35 percent clay content and also averages 5 to 35 percent by volume rock fragments. Base saturation is estimated to be 60 to 75 percent, by sum of cations, in at least the upper parts of the argillic horizon. The mean annual soil temperature at 20 inches is about 49 to 53°F. and flucturates by more than 9°F. during the year. The soil temperature at 20 inches exceeds 41°F. from April 15 through November 30 and exceeds 47°F. from May 1 through November 1 in most years. The soil moisture control section is usually moist in all parts from December 1 through May 15 and dry in all parts from July 15 through October 30.

The Holland family soils in this survey have an approximate 900 year old pumice deposit from 4 to 20 inches thick. This pumice deposit is always less than half the thickness of the combined A and B horizons of the underlying soil. The pumice overburden consists of an A, or an A-C horizon development in the deeper deposits.

The pumice A horizon is 2 to 6 inches thick and has dry color of 10YR 5/1, 5/2, 5/3, 6/2, 6/3 and moist color of 10YR 3/2, 3/3, 3/4, 4/2, 4/3. Texture is coarse loamy sand or coarse sand and contains 25 to 45 percent gravel mainly of the less than 0.6 inch size. It is single grained and soil pH is neutral. The pumic overburden C horizon, if present, has dry color of 10YR 7/3, 7/4, 8/3 and moist color of 10YR 6/3 or 7/3. Texture is coarse sand and contains 65 to 90 percent by volume gravel mainly of the 0.2 to 1.0 inch size. It is single grained and soil pH is neutral.

The soil underlying the pumice overburden has an A-B horizon development.

The A horizon is 4 to 9 inches thick and have dry color of 10YR 5/4, 6/3, 6/4; 7.5YR 4/4, 5/4 and moist color of 10YR 3/4, 4/4; 7.5YR 3/4, 4/4. Texture is loam and contains 5 to 20 percent by volume weathered cinder gravels. Structure is granular or subangular blocky and soil pH is neutral to slightly acid.

The B horizon has dry color of 10YR 5/4, 6/4, 6/6; 7.5YR 5/4, 5/6, 6/4 and moist colors of 10YR 3/4, 3/6, 4/4, 4/6; 7.5YR 3/4, 4/4, 4/6. Texture is clay loam or loam and contains from 5 to 35 percent by volume rock fragments. Structure is subangular or angular blocky and soil pH is neutral to slightly acid.

INDIAN CREEK FAMILY

The Indian Creek family consists of shallow, well drained soils that formed in material derived from basalt and tuff. Permeability is very slow. These soils are on 0 to 5 percent slopes and occur on basalt plateaus at 4300 to 5300 feet elevation. These soils are underlain by a cemented silica duripan. The mean annual air temperature is 44 to 49°F. The annual precipitation is 12 to 14 inches, most of which falls in winter as snow. The frost free season is 80 to 110 days.

Taxonomic Class: Clayey, montmorillonitic, mesic, shallow, Xerollic Durargids.

Reference Pedon: Indian Creek family cobbly clay loam on a nearly level basalt plateau at 5020 feet elevation under low sagebrush, phlox sp., scattered western juniper, bluebunch wheatgrass and cheatgrass rangeland. The soil was moist below 5 inches when described on 5/8/79. (Colors are for dry soil unless otherwise stated.)

A11-0 to 3 inches; brown (7.5YR 5/4) cobbly clay loam, dark brown (7.5YR 3/2) moist; weak to moderate medium platy structure which parts into weak to moderate very fine and fine granular; slightly hard, friable, sticky and plastic; few moderately thick clay films on ped faces; 20 percent cobbles extending from the surface into the profile and 10 to 15 percent gravel by volume; common very fine and fine, and few medium roots; few very fine pores; neutral (pH 6.8); clear smooth boundary.

A12–3 to 5 inches; light brown (7.5YR 6/4) clay loam, brown (7.5YR 4/4) moist; moderate medium and coarse platy structure; hard, firm, sticky and plastic; few moderately thick clay films on ped faces; 10 percent gravel by volume; common very fine and fine, and few medium and coarse roots; few very fine pores; neutral (pH 6.6); clear smooth boundary.

B2t–5 to 11 inches; reddish brown (5YR 5/4) clay, brown (7.5YR 4/4) moist; strong medium and coarse platy structure; hard, very firm, very sticky and very plastic; common moderately thick clay films on ped faces; few to common very fine, fine, medium and coarse roots; few very fine pores; slightly acid (pH 6.4); abrupt smooth boundary.

Csim–11 to 60 inches; weakly to strongly cemented silica duripan composed of strong medium and coarse plates of 1 to 5 mm in thickness; few very fine and fine roots between the plates to the 17 inch depth; material becomes massive and strongly cemented, below 30 inches in depth.

Reference Pedon Location: Modoc County, California, about 200 feet west of road and about 1800 feet west and 2200 feet north of SE corner as Section 4, T44N., R11E., (#498).

Range in Characteristics: Depth to the silica duripan ranges from 10 to 20 inches. The silica duripan may be only a few millimeters to several feet thickness and underlain by basalt bedrock or volcanic tuff. The control section averages 35 to 60 percent clay. The mean annual soil temperature at the contact is about 47 to 52°F. and fluctuates by more then 9°F. during the year. The soil temperature at the duripan contact exceeds 41°F. from April 1 through December 1. The 4 to 12 inch soil moisture control section, or the duripan contact if shallower, is usually dry in all parts from June 15 through November 15, and moist in all parts from December 15 through May 1.

The A horizon is 2 to 5 inches thick with dry color of 10YR 5/3, 5/4, 6/3; 7.5YR 5/4, 6/4 and moist color of 10YR 3/3, 3/4, 4/3, 4/4; 7.5YR 3/2, 3/4, 4/4. Texture is loam or clay loam and contains 25 to 50 percent surface gravel, cobbles and some stones. Structure is platy or subangular blocky and soil pH is neutral to slightly acid.

The B horizon has dry color of 10YR 5/3, 5/3; 7.5YR 4/4, 5/4, 5/6; 5YR 4/4, 5/4 and moist color of 10YR 4/3, 4/4; 7.5YR 3/4, 4/4; 5YR 3/4, 4/4. Texture is clay or clay loam and may contain up to 15 percent by volume coarse fragments. Structure is platy or angular blocky and soil pH is slightly acid to neutral.

The Csim horizon is platy to massive and strongly cemented or indurated and may have opal coated laminar plates cemented in a mosiac.

INVILLE FAMILY

The Inville family consists of deep and moderately deep, well drained soils formed from andesite, basalt, volcanic ash and geologically recent pyroclastic pumice. Permeability is rapid in the pumice overburden to moderate below. These soils are found on old alluvial fans, basalt plateaus and sideslopes of volcanic mountain uplands with 2 to 30 percent slopes. Elevations are 5300 to 6500 feet. Mean annual air temperature is 42 to 46°F. Annual precipitation is 20 to 40 inches which mostly falls during winter as snow. The frost free season is 70 to 100 days.

Taxonomic Class: Loamy-skeletal, mixed, frigid, Ultic Haploxeralfs.

Reference Pedon: Inville family very gravelly loamy coarse sand on a nearly level alluvial fan at 5960 feet elevation under Jeffrey pine and ponderosa pine forest with a scattered bitterbrush understory. The soil was moist throughout when described on 5/20/80. (Colors are for dry soil unless otherwise stated.)

01–2 to 0 inches; Jeffrey and ponderosa pine needles, twigs and cones.

A1–0 to 2 inches; dark grayish brown (10YR 4/2) very gravelly loamy coarse sand, very dark brown (10YR 2/2) moist; single grained; loose, non-sticky and non-plastic; 40 percent pumice gravel by volume; many very fine and fine and common medium roots; slightly acid (pH 6.2); abrupt smooth boundary.

C1–2 to 6 inches; pale brown (10YR 6/3) very gravelly loamy coarse sand, brown (10YR 5/3) moist; single grained; loose, non-sticky and non-plastic; 40 percent pumice gravel by volume; common very fine and fine and common medium roots; neutral (pH 6.6); clear smooth boundary.

C2–6 to 12 inches; grayish brown (2.5YR 5/2) gravelly loamy fine sand, dark grayish brown (10YR 4.2) moist; massive; soft, very friable, non-sticky and non-plastic; 15 percent pumice gravel by volume; common very fine and fine and common to many medium and coarse roots; neutral (pH 6.7); abrupt smooth boundary.

IIIA1b–12 to 15 inches; yellowish brown (10YR 5/4) very gravelly sandy loam, dark brown (7.5YR 4/4) moist; moderate fine and medium granular structure; soft, very friable, slightly sticky and non-plastic; 50 percent gravel by volume; common very fine, fine, medium and coarse roots; slightly acid (pH 6.4); clear smooth boundary.

IIIB21tb–15 to 21 inches; yellowish brown (10YR 5/4) very gravelly sandy loam, dark yellowish brown (10YR 3/4) moist; weak to moderate fine and medium subangular blocky structure which parts into weak fine and medium granular; slightly hard, very friable, slightly sticky and slightly plastic; few to common thin clay films on ped faces; 55 percent gravel by volume mainly of the less than 0.4 inch size; common very fine, fine, medium and coarse roots; slightly acid (pH 6.2); gradual wavy boundary.

IIIB22tb–21 to 32 inches; yellowish brown (10YR 5/4) very gravelly loam, dark yellowish brown (10YR 3/4) moist; moderate fine and medium subangular blocky structure; hard, friable, sticky and slightly plastic; few to common thin clay films on ped faces; 40 percent gravel by volume of less than 0.4 inch size; common very fine, fine and medium and few coarse roots; slightly acid (pH 6.4); gradual wavy boundary.

IIIB3tb–32 to 60 inches; light yellowish brown (10YR 6/4) very gravelly loam, brown (7.5YR 4/4) moist; moderate to strong medium subangular and angular blocky structure; hard, friable, sticky and slightly plastic; few thin clay films on ped faces; 55 percent gravel by volume; few to common very fine and fine and few coarse roots; slightly acid (pH 6.4).

Reference Pedon Location: Siskiyou County, California, about 300 feet east and 750 feet north of SW corner of Section 12, T.44N., R.3E.

Range in Characteristics: Depth to a lithic contact is greater than 40 inches. The control section averages 18 to 27 percent clay and also averages 35 to 70 percent by volume gravel, cobbles and some stones consisting of weathered cinders, andesite or basalt. Base saturation is estimated to be 60 to 75 percent, by sum of cations, in at least the upper parts of the argillic horizon. The mean annual soil temperature at a depth of 20 inches is 42 to 47°F. The 5 to 15 inch soil moisture control section is moist in all parts from about November 15 through May 30. It is dry in all parts from about August 1 through October 20 in most years. The soil temperature at the 20 inch depth exceeds 41°F. from May 15 through November 15 and exceeds 47°F. from June 15 through October 15 in most years.

The Inville family soils in this survey area have an approximate 900 year old pumice and/or ash deposit of 8 to 20 inches in thickness. The pumice or ash deposit is always less than half the thickness of the combined A

and B horizons of the underlying soil. The pumice or ash overburden consists of an A-C horizon development. The A horizon is 2 to 6 inches thick and has dry color of 10YR 4/2, 4/3, 5/2, 5/3, 5/4 and moist color of 10YR 2/2, 3/2, 3/3. Texture is loamy coarse sand or loamy sand and contains 25 to 50 percent by volume gravel mainly of the less than 0.4 inch size. It is single grained and soil pH is slightly acid to neutral. The C horizon has dry color of 10YR 5/3, 6/3, 6/4, 7/2, 7/3, 8/3; 2.5YR 5/2 and moist color of 10YR 4/2, 5/3, 6/3, 6/4, 7/3. Texture is loamy coarse sand, loamy fine sand or coarse sand and contains 15 to 90 percent by volume gravel mainly of the 0.2 to 1.0 inch size. It is single grained or massive and soil pH is neutral to slightly acid.

The soil underlying the pumice or ash overburden has an A-B horizon development.

The A horizon is 3 to 7 inches thick with dry color of 10YR 4/3, 4/4, 5/3, 5/4, 6/3; 7.5YR 5/4 and moist color of 10YR 3/4, 4/2, 4/3; 7.5YR 3/4. Texture is fine sandy loam or sandy loam and contains 15 to 60 percent by volume gravel, cobbles and stones. Structure is granular or subangular blocky and soil pH is slightly acid to neutral.

The B horizon has dry color of 10YR 5/4, 6/3, 6/4; 7.5YR 5/4 and moist color of 10YR 3/4, 4/3, 4/4; 7.5YR 4/4. Texture is sandy loam, loam, or clay loam and contains 35 to 70 percent by volume rock fragments. Structure is subangular or angular blocky and soil pH is medium acid to neutral.

JACKET FAMILY

The Jacket family consists of deep and moderately deep, well drained soils derived from volcanic ash, basalt or tuff. Permeability is slow. These soils are on 1 to 50 percent slopes and occur on smooth sideslopes, along drainage ways and concave areas of mountain uplands at 4400 to 5800 feet elevation. The climate is cool with 44 to 48°F mean annual air temperature. Annual precipitation is 16 to 25 inches which mostly falls during the winter as snow. Forst free season is 80 to 110 days.

Taxonomic Class: Fine, montmorillonitic, mesic, Pachic Ultic Argixerolls.

Reference Pedon: Jacket family loam, on a 8 percent northwest facing mountain sideslope at 4640 foot elevation under a ponderosa/Jeffrey pine forest with a few white fir and incense-cedar and an understory of greenleaf manzanita, bitterbrush, squawcarpet, Ross's sedge and grasses. Soil was dry throughout when described on 8/22/78. (Colors are for dry soil unless otherwise stated.)

01–2 to 0 inches; ponderosa and Jeffrey pine needles and twigs.

A11–0 to 2 inches; dark brown (7.5YR 4/4) loam, dark reddish brown (5YR 3/2) moist; moderate fine and very fine granular structure; slightly hard, friable, sticky and slightly plastic; 5 percent gravel by volume; common fine and very fine roots; slightly acid (pH 6.2); clear smooth boundary.

A12–2 to 9 inches; reddish brown (5YR 4/4) loam, dark reddish brown (5YR 3/3) moist; weak fine and medium platy structure parting to moderate fine subangular blocky; slightly hard, friable, sticky and plastic; 5 percent gravel by volume; common to many fine, very fine and medium roots; many fine and very fine pores; slightly acid (pH 6.4); clear wavy boundary.

B21t–9 to 14 inches; reddish brown (5YR 4/4) clay loam, dark reddish brown (5YR 3/3) moist; moderate fine and medium subangular blocky structure; hard, friable, sticky and plastic; 10 percent gravel by volume; common to many fine, very fine and medium roots; many fine, very fine and few medium roots; many fine, very fine and few medium pores; neutral (pH 6.6); gradual wavy boundary.

B22t–14 to 36 inches; reddish brown (5YR 4/4) light clay, dark reddish brown (5YR 3/3) moist; moderate medium and coarse prismatic structure parting to moderate and strong fine and medium angular and subangular blocky; hard firm, very sticky and plastic; many distinct clay films on ped faces; 10 to 15 percent gravel by volume; few coarse, common medium and many very fine roots; many fine, very fine and few medium pores; neutral (pH 6.6); gradual wavy boundary.

B3t–36 to 60 inches; yellowish red (5YR 4/6) gravelly clay loam, dark reddish brown (5YR 3/4) moist; moderate medium and coarse prismatic structure parting to moderate and strong angular and subangular blocky; hard, firm, sticky and plastic; many distinct clay films on ped faces; 30 percent gravel by volume; few medium and coarse and common fine and very fine roots; many fine and very fine pores; neutral (pH 6.6).

Reference Pedon Location: Modoc County, California, about 100 feet south of road and about 2000 feet west and 2100 feet north of SE corner of Section 20, T41N., R7E.

Range in Characteristics: Depth to bedrock is 20 to 40 inches in soil map units 187, 188 and 189 and greater than 40 inches in map units 167 and 168. The control section averages 35 to 50 percent clay content and coarse fragments also average from 5 to 35 percent by volume. Base saturation by the ammonium acetate method is estimated to be between 60 to 75 percent normally throughout the upper 30 inches of soil. The mean annual soil temperature at a depth of 20 inches is 47 to 52°F. and fluctuates by more than 9°F. during the year. The soil temperature at the 20 inch depth exceeds 41°F. from April 15 through November 30 and exceeds 47°F. from May 1 through November 1 in most years. The 4 to 12 inch soil moisture control section is usually moist in all parts from December 1 through May 15 and dry in all parts from July 15 through October 30.

The A horizons are 8 to 16 inches thick with dry color of 10YR 4/2, 4/3, 5/2; 7.5YR 4/4, 5/2; 5YR 4/3, 4/4 and moist color of 10YR 2/2, 3/2, 3/3; 7.5YR 3/2; 5YR 2.5/2, 3/2, 3/3. Textures are loam or clay loam and rock fragments may make up to 30 percent by volume. Structure is granular, platy or subangular blocky and soil pH is slightly acid to neutral.

The B horizons make up the remaining soil and have

dry color of 7.5YR 4/2, 4/4, 4/6, 5/4; 5YR 4/3, 4/4, 4/6, 5/3, 5/4 and moist color of 10YR 3/3; 7.5YR 3/2, 4/4; 5YR 3/2, 3/3, 3/4, 4/3 or 4/4. The upper parts of the argillic B horizons have mollic colors and may include the whole soil depth. Texture is clay loam or clay and may contain up to 35 percent by volume coarse fragments. Structure is prismatic and, or blocky and soil pH is slightly acid to neutral.

JACKNIFE FAMILY

The Jacknife family consists of deep, well drained soils that formed in alluvial material derived from basalt and ash. Permeability is slow. These soils are on alluvial fans and undulating volcanic plateaus with slopes of 1 to 5 percent. Elevations range from 4400 to 5300 feet. Annual precipitation is 14 to 18 inches most of which falls during the winter as snow. The mean annual air temperature is 44 to 48°F. The frost free season is 80 to 110 days.

Taxonomic Class: Fine, montmorillonitic, mesic, Pachic Argixerolls.

Reference Pedon: Jacknife family loam on a nearly level basalt plateau at 4700 foot elevation under big sagebrush, Idaho fescue and Junegrass with a few scattered ponderosa pine and western juniper. Soil was dry to 32 inches when described on 10/12/78. (Colors are for dry soil unless otherwise noted.)

A1–0 to 4 inches; brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; weak and moderate medium and coarse platy structure parting to moderate fine and very fine granular; hard, friable, sticky and plastic; many very fine and fine, few medium roots; many very fine and fine, few medium tubular pores; slightly acid (pH 6.2); clear smooth boundary.

B1t–4 to 9 inches; brown (10YR 4/3) silty clay loam, dark brown (10YR 3/3) moist; moderate medium and coarse platy structure parting to moderate fine and medium subangular blocky; hard, friable, sticky and plastic; few thin clay films on ped faces; many very fine and fine, few medium roots; many very fine and fine, few medium tubular pores; slightly acid (pH 6.4); clear wavy boundary.

1t–9 to 17 inches; brown (7.5YR 5/4) heavy silty clay loam, dark reddish brown (5YR 3/3) moist; moderate and strong medium and coarse prismatic structure parting to moderate and strong medium and coarse subangular blocky and angular blocky; very hard, friable, very sticky and plastic; common moderately thick clay films on ped faces; common very fine and fine, few medium roots; many very fine and fine, common medium tubular pores; slightly acid (pH 6.4); gradual wavy boundary.

B22t–17 to 32 inches; brown (7.5YR 4/4) silty clay, dark reddish brown (5YR 3/3) moist, moderate and strong medium and coarse prismatic structure parting to strong medium and coarse angular blocky and subangular blocky; very hard, firm, very sticky and very plastic; many moderately thick clay films on ped faces; few very fine, fine and medium roots; many very fine, common fine and medium pores; slightly acid (pH 6.4); gradual wavy boundary.

B23t–32 to 42 inches; brown (7.5YR 5/4) clay, dark brown (7.5YR 3/4) moist; moderate and strong medium and coarse prismatic structure parting to moderate and strong fine and medium subangular blocky and angular blocky; hard, friable, very sticky and plastic; many moderately thick clay films on ped faces; few very fine and fine roots; many very fine and fine pores; neutral (pH 6.6); clear wavy boundary.

IIC–42 to 60 inches; brown (7.5YR 5/4) 2 to 6 inch thick stratified lenses of loam, sandy loam and loamy sand, dark brown (7.5YR 4/4) moist; massive structure; hard to loose, friable to loose, sticky to nonsticky and slightly plastic to nonplastic; few very fine roots; few very fine and fine pores; neutral (pH 6.6).

Reference Pedon Location: Modoc County, California, about 1150 feet west and 600 feet north of SE corner of Section 4, T42N., R7E.

Range in Characteristics: Depth to a lithic contact is grater than 40 inches. The control section averages 35 to 50 percent clay content. The mean annual soil temperature at a depth of 20 inches is 47 to 52°F. and fluctuates by more than 9°F. during the year. The soil temperature at the 20 inch depth exceeds 41°F. from April 1 through December 1 and exceeds 47°F. from April 15 through November 15 in most years. The 4 to 12 inch soil moisture control section is usually moist in all parts from December 1 through May 1 and dry in all parts from July 1 thorugh October 30.

The A horizons are 4 to 12 inches thick with dry color of 10YR 4/2, 4/3, 5/2, 5/3; 7.5YR 4/2, 4/4 and moist color of 10YR 2/2, 3/2, 3/3; 7.5YR 3/2; 5YR 3/2, 3/3. Texture is loam or clay loam. Structure is platy or granular and soil pH is slightly acid to neutral.

The B horizons have dry color of 10YR 4/3, 5/3, 5/4; 7.5YR 4/2, 4/4 5/4; 5YR 4/3, 4/4, 5/3, 5/4 and moist color of 10YR 3/3, 3/4; 7.5YR 3/2, 3/4, 4/4; 5YR 3/3, 4/3, 4/4. The upper parts of the argillic B horizons

have mollic colors and may include the whole soil depth. Texture is clay loam, silty clay loam, clay or silty clay. Structure is prismatic, platy or blocky and soil pH is slightly acid to neutral.

The C horizons, if present, have dry color of 10YR 6/2, 6/3, 6/4; 7.5YR 5/4, 6/2, 6/4 and moist color of 10YR 4/4, 5/2, 5/3, 5/4; 7.5YR 4/4, 5/4. Texture is loamy sand, sandy loam, loam, or clay loam and may contain up to 40 percent by volume gravel. It is massive or has been deposited by stratified fluvial alluviation. Soil pH is neutral.

KEATING FAMILY

The Keating family consists of moderately deep, well drained soils that formed from material derived from basalt or volcanic tuff. Permeability is slow. These soils are on volcanic plateaus and mountain sideslopes of 1 to 60 percent slopes. Elevation ranges from 4400 to 6000 feet. Annual precipitation is 14 to 18 inches most of which falls during the winter as snow. Mean annual air temperature is 44 to 49°F. The frost free season is 80 to 110 days.

Taxonimic Class: Fine, montmorillonitic, mesic, Typic Argixerolls.

Reference Pedon: Keating family, cobbly clay loam on a nearly level basalt plateau at 4560 feet elevation under big sagebrush, vetch and bunchgrass rangeland. Soil was moist below 6 inches when described on 6/5/79. (Colors are for dry soil unless otherwise stated.)

A1– 0 to 2 inches; dark grayish brown (10YR 4/2) cobbly clay loam, very dark grayish brown (10YR 3/2) moist; moderate to strong fine granular structure; hard, friable, sticky and plastic; 10 percent cobbles and 10 percent gravel by volume; many fine and very fine roots; neutral (pH 6.8); abrupt smooth boundary.

B1t–2 to 6 inches; brown (10YR 4/3) heavy clay loam, dark brown (7.5YR 3/2) moist; weak fine and medium subangular blocky structure parting to moderate to strong fine and medium granular; slightly hard, friable, sticky and plastic; few thin clay skins on ped faces; common fine, very fine and medium roots; common fine and very fine tubular pores; neutral (pH 6.8); clear smooth boundary.

B21t–6 to 14 inches; brown (10YR 4/3) clay, dark brown (10YR 3/3) moist; moderate to strong medium prismatic structure parting to strong medium and coarse angular blocky; very hard, firm, very sticky and plastic; common thin clay skins on ped faces; common fine and very fine roots; few very fine tubular pores; neutral (pH 7.0); clear smooth boundary.

B22t– 14 to 32 inches; brown (10YR 4/3) clay, dark yellowish brown (10YR 3/4) moist; moderate to strong medium angular and subangular blocky structure; common thin clay skins on ped faces; very hard, friable, very sticky and plastic; few fine and very fine roots; few very fine tubular pores; mildly alkaline (pH 7.4); abrupt smooth boundary.

R–32 plus inches; fractured hard basalt.

Reference Pedon Location: Modoc County, California, about 500 feet west and 2300 feet south of the NE corner of Section 16, T47N., R.8E.

Range in Characteristics: Depth to bedrock is 20 to 40 inches. In map units 155, 156, 157 and 180 the bedrock is predominately a soft volcanic tuff that can be dug with a spade. In the other map units it is mainly over hard fractured basalt bedrock. The clay content of the control section averages 35 to 60 percent and up to 35 percent by volume rock fragments may be found but they normally range from 0 to 5 percent. The mean annual soil temperature at a depth of 20 inches is 47 to 52°F. and fluctuates by more than 9°F. during the year. The soil temperature at the 20 inch depth exceeds 41°F. from April 1 through December 1 and exceeds 47°F. from April 15 through November 15 in most years. The 4 to 12 inch soil moisture control section is usually moist in all parts from December 1 through May 1 and dry in all parts from July 1 through October 30.

The A horizon is 2 to 8 inches thick with dry color of 10YR 4/2, 4/3, 5/2, 5/3, 5/4 and moist color of 10YR 2/2, 3/2, 3/3. Texture is loam to clay loam and rock fragments may range from 0 to 40 percent on the surface and 0 to 25 percent by volume in the A horizon itself. Structure is granular or subangular blocky and soil pH is neutral.

The B horizon makes up the remainder of the soil with dry color of 10YR 4/3, 4/4, 5/3, 5/4, 6/3; 7.5YR 4/4, 5/4 and moist color of 10YR 3/3, 3/4, 4/3, 4/4; 7.5YR 3/2, 3/4, 4/4. Mollic colors occupy the upper 8 to 20 inches of soil and normally includes the upper parts of the argillic B horizon. Texture is clay loam or clay. Structure is prismatic and angular or subangular blocky and soil pH is neutral to mildly alkaline.

KINZEL FAMILY

The Kinzel family consists of moderately deep, well drained soils formed from ash, cinders, andesite, basalt and geologically recent pumice. Permeability is moderately rapid to the paralithic contact. These soils are on 1 to 40 percent slopes and occur on hummocky areas, concave depressions and lower mountain sideslopes in the Medicine Lake Highlands at 6500 to 7600 feet elevation. The climate is cool with 36 to 40°F mean annual air temperature and 35 to 45 inches annual precipitation which mostly falls during winter as snow. The frost free season is 40 to 80 days.

Taxonomic Class: Medial-skeletal, Andic Cryumbrepts.

Reference Pedon: Kinzel family gravelly loamy sand on a nearly level concave area of the Medicine Lake Caldera at 6830 feet elevation under an open lodgepole pine and western white pine forest with an understory of rabbitbrush and a few grasses. The soil was dry in all parts when described on 10/9/79. (Colors are for dry soil unless otherwise states.)

Pumice and cinder gravel pavement on surface.

A11–0 to 2 inches; dark grayish brown (10YR 4/2) gravelly loamy sand, very dark brown (10YR 2/2) moist; single grained; loose, non-sticky and non-plastic; 20 percent pumice gravel by volume; many very fine, common fine and few medium roots; strongly acid (pH 5.5); clear wavy boundary.

A12-2 to 6 inches; dark grayish brown (10YR 4/2) gravelly loamy sand, very dark brown (10YR 2/2) moist; single grained; loose, non-sticky and non-plastic; 30 percent pumice and basalt gravel by volume; many very fine, common fine and few medium roots; strongly acid (pH 5.5); clear wavy boundary.

IIA13–6 to 10 inches; grayish brown (10YR 5/2) very cobbly sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium subangular blocky structure; soft, very friable, non-sticky and non-plastic; 35 percent cobbles and 32 percent gravel by weight; many very fine and common fine and medium roots; many very fine and fine pores; weakly smeary; medium acid (pH 6.0); clear wavy boundary.

IIB21–10 to 20 inches; yellowish brown (10YR 5/4) extremely stony sandy loam, dark yellowish brown (10YR 3/4) moist; weak fine and medium subangular blocky structure; soft, very friable, non-sticky and non-plastic; 36 percent stones, 25 percent gravel and 14 percent cobbles by weight; common very fine and fine and few medium roots; many very fine and fine pores; weakly smeary, slightly acid (pH 6.5); gradual wavy boundary.

IIB22–20 to 30 inches; pale brown (10YR 6/3) extremely stony sandy loam, brown (10YR 4/3) moist; weak fine and medium subangular blocky structure; soft, very friable, non-sticky and non-plastic; 36 percent cobbles, 32 percent stones and 21 percent gravel by weight; common very fine and fine, few medium roots; many very fine and fine pores; weakly smeary; slightly acid (pH 6.5); abrupt wavy boundary.

IICr–30 to 41 plus inches; light brownish gray (2.5Y 6/2) weakly cemented and compacted volcanic ash with 60 percent by volume andesite gravel and few cobbles, olive brown (2.5Y 4/4) moist; ash material textures to a sandy loam when rubbed; massive, very hard; firm; non-sticky and non-plastic; faint silica deposits desciminated throughout; very few fine and very fine roots.

Reference Pedon Location: Siskiyou County, California, about 200 feet west of road and about 1800 feet west and 800 feet south of the NE corner of Section 3, T.43N., R.3E.

Range in Characteristics: Depth to the root limiting paralithic contact is 20 to 40 inches. Rock fragments average 40 to 80 percent by volume in the control section. The mean annual soil temperature at 20 inches is 38 to 42°F. The soil temperature at the 20 inch depth exceeds 41°F. from July 1 through October 30 and exceeds 47°F. from July 20 through September 25 in most years. The mean summer soil temperature at 20 inches is less than 47°F. in most years. The 5 to 15 inch soil moisture control section is usually moist in all parts from November 1 through June 15 and dry in all parts from August 20 through October 10 in most years. The bulk density of the soil fine earth fraction is between 0.80 and 1.00 at 1/3 bar water tension and the ratio of measured clay to 15 bar water is less than 1.25 normally throughout the upper 30 inches of soil.

The Kinzel family can have a pumice overburden of up to 12 inches thick composed of an approximately 900 year old pumice deposit. This deposit is always less than half the thickness of the underlying combined A & B horizons. The pumice overburden, if present, consists of an A, or an A-C horizon development in the deeper deposits. If present the pumice A horizon has dry color of 10YR 5/1, 5/2, 5/3, and moist color of 10YR 3/2, 3/3

and may be up to 6 inches thick. Texture is coarse loamy sand or coarse sandy loam and contains from 35 to 60 percent by volume pumice gravel. It is single grained and soil pH is moderately acid. The pumice overburden C horizon, if present, has dry color of 10 YR 7/2, 7/3, 8/3, 8/3 and moist color of 10YR 5/2, 6/2, 6/3, 7/2, 7/3. Texture is coarse loamy sand or coarse sand and contains from 50 to 90 percent by volume pumice gravel. It is single grained and soil pH is moderately acid.

The loam textured soil beneath the pumice overburden, if present, has an A-B-Cr horizon development.

The A horizon is 10 to 20 inches thick with dry color of 10YR 4/2, 4/3, 5/2, 5/3, 5/4 and moist color of 10YR 2/2, 3/2, 3/3; 7.5YR 3/2. Texture is coarse sandy loam, sandy loam or loam and contains 20 to 50 percent coarse fragments by volume. Structure is single grained or granular and soil pH is strongly acid to medium acid.

The B horizon has dry color of 10YR 5/3, 5/4, 6/3, 6/4, 6/6; 7.5YR 6/4 and moist color of 10YR 3/4, 4/3, 4/4, 4/6; 7.5YR 3/4, 4/4. Texture is sandy loam or loam and contains 40 to 85 percent by volume rock fragments. Structure is subangular blocky and soil pH is medium acid to slightly acid.

The Cr horizon is normally compacted and weakly cemented with disseminated silica. It is massive and very hard and severely restricts root growth.

Additional Data: Lincoln Lab. Sample # S79Ca-093-10.

LAMONDI FAMILY

The Lamondi family consists of deep, well drained soils that formed from basalt, andesite or volcanic tuff. Permeability is moderate. These soils are on mountain sideslopes of 2 to 60 percent slope. They occur at elevations of 5500 to 7500 feet. The annual precipitation is 20 to 30 inches and mostly falls during the winter as snow. Mean annual air temperature is 40 to 46°F. The frost free season is 60 to 90 days.

Taxonomic Class: Loamy-skeletal, mixed, frigid, Pachic Ultic Haploxerolls.

Reference Pedon: Lamondi family, gravelly loam on a 22 percent southwest facing mountain sideslope at 7280 feet elevation under a white fir forest with few forbes and grasses. Soil was dry in all parts when described on 10/19/70. (Colors are for dry soil unless otherwise noted.)

01–4 to 0 inches; black (10YR 2/1) litter of white fir needles and bark; few fine and medium roots; abrupt smooth boundary.

A11–0 to 9 inches; brown (7.5YR 4/4) gravelly loam, dark brown (7.5YR 3/2) moist; weak fine and medium granular structure; soft, very friable, slightly sticky and slightly plastic; 20 percent gravel by volume; many very fine, fine and medium and few coarse roots; many very fine and medium interstitial pores; slightly acid (pH 6.2); gradual smooth boundary.

A12–9 to 19 inches; brown (7.5YR 5/4) very gravelly loam, dark brown (7.5YR 3/2) moist; weak to moderate fine and medium granular structure; soft, very friable, nonsticky and nonplastic; 35 percent gravel by volume; many very fine, fine medium and coarse roots; many fine interstitial and common very fine tubular pores; slightly acid (pH 6.4); clear wavy boundary.

A13–19 to 26 inches; brown (7.5YR 5/4) very gravelly loam, dark reddish brown (5YR 3/3) moist; weak medium subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; few thin clay films on ped faces; 40 percent gravel and 5 percent cobbles by volume; many medium and common very fine and fine roots; many very fine and fine tubular pores and many very fine interstitial pores; slightly acid (pH 6.4); gradual irregular boundaries.

B2–26 to 42 inches; brown (10YR 5/3) extremely gravelly loam, dark yellowish brown (10YR 3/4) moist; weak medium and coarse subangular blocky structure; soft, very friable, nonsticky and nonplastic; 60 percent gravel and 20 percent cobbles by volume; common very fine and fine pores; many very fine and fine interstitial pores; slightly acid (pH 6.2); gradual irregular boundary.

R–42 to 51 inches; gray (7.5YR 5/0) moderately weathered and fractured volcanic tuff; dark gray (7.5YR 3/0) moist; very few, very fine, fine and coarse roots; abrupt wavy boundary.

IIR–51 plus inches; reddish brown (2.5YR 4/4), moderately weathered and fractured lapilli tuff; dark reddish brown (2.5YR 3/4) moist; very few coarse roots.

Reference Pedon Location: Modoc County, California, about 500 feet west and 1050 feet south of the NE corner of Section 1, T44N., R.14E.

Range in Characteristics: Depth to bedrock is greater than 40 inches. The control section averages 12 to 24 percent clay content and coarse fragments also average 35 to 60 percent by volume. Base saturation by the ammonium acetate method is estimated to be between 50 and 75 percent throughout the upper 30 inches of the soil. The mean annual soil temperature at a depth of 20 inches is 41 to 47°F. and fluctuates by more than 9°F. during the year. The soil temperature at the 20 inch depth exceeds 41°F. from June 15 through October 15 in most years. The 5 to 15 inch soil moisture control section is usually moist in all parts from November 15 through May 30 and dry in all parts from August 1 through October 20.

The A horizon is 24 to greater than 40 inches thick and commonly make up the whole soil depth with dry color of 10YR 4/2, 4/3, 5/3; 7.5YR 4/2. 4/4, 5/4 and moist color of 10YR 3/2, 3/3; 7.5YR 3/2, 5YR 3/2, 3/3. Texture is loam or sandy loam and contains from 20 to 70 percent by volume gravel, cobbles and stones. Structure is granular to subangular blocky and soil pH is medium acid to slightly acid.

The B horizon, if present, has dry color of 10YR 5/3, 5/4; 7.5YR 5/4, and moist color of 10YR 3/4, 4/3, 4/4; 7.5YR 3/4, 4/4. Texture is sandy loam or loam and contains from 35 to 80 percent by volume gravel and cobbles and occasionally a few stones. Structure is subangular blocky and soil pH is medium acid to slightly acid.

LAPINE FAMILY

The Lapine family consists of deep and moderately deep, somewhat excessively drained soils formed from pyroclastic cinders and pumice over andesite, and basalt. Permeability is rapid. These soils are on 1 to 60 percent slopes and occur in the caldera and on sideslopes of volcanic mountain uplands in the Medicine Lake Highlands at 6500 to 7600 feet elevation. The climate is cool with 35 to 45 inches annual precipitation which mostly falls as snow during winter. Mean annual air temperature is 36 to 40°F. The frost free season is 40 to 80 days.

Taxonomic Class: Cindery, Typic Cryorthents.

Reference Pedon: Lapine family very gravelly coarse sand on a 40 percent northeast facing mountain sideslope at 7100 feet elevation under a mixed alpine conifer forest of red fir, western white pine, mountain hemlock and lodgepole pine. Soil was moist below 13 inches when described on 10/12/79. (Colors are for dry soil unless otherwise noted.)

01–1 to 0 inches; continuous duff mat of needles and twigs.

A1–0 to 2 inches grayish brown (10YR 5/2) very gravelly coarse sand, very dark grayish brown (10YR 3/2) moist; single grained; loose, non-sticky and non-plastic; 35 percent by volume pumice gravel mainly of the less than 0.4 inch size; many very fine and fine roots; medium acid (pH 5.6); abrupt smooth boundary.

C1–2 to 13 inches; very pale brown (10YR 8/3) extremely gravelly coarse sand, very pale brown (10YR 7/3) moist; single grained; loose, non-sticky and non-plastic; 70 percent by volume pumice gravel mainly of the less than 3/4 inch size; many very fine, fine and common medium roots; medium acid (pH 5.6) clear wavy boundary.

C2–13 to 23 inches; very pale brown (10YR 8/3) extremely gravelly coarse sand, very pale brown (10YR 7/3) moist; single grained; loose, non-sticky and non-plastic; 90 percent by volume pumice gravel mainly of the 0.2 to 1.0 inch size; many very fine, fine, common medium and few coarse roots; medium acid (pH 5.8); abrupt wavy boundary.

IIA1b–23 to 26 inches; yellowish brown (10YR 5/4) very gravelly sandy loam, dark yellowish brown (10YR 3/4) moist; moderate fine granular structure; loose, non-sticky and non-plastic; 50 percent by volume weathered cinder gravel mainly of the less than 3/4 inch size, 5 percent by volume basalt cobbles; many very fine, fine, common medium and coarse roots; medium acid (pH 6.0); clear wavy boundary.

IIIC1–26 to 38 inches; brownish yellow (10YR 6/6) extremely stony sandy loam, dark yellowish brown (10YR 4/4) moist; massive; soft, loose, non-sticky and non-plastic; 30 percent stones and 20 percent cobbles by volume of basalt and 35 percent by volume weathered cinder gravel mainly of the less than 3/4 inch size; many very fine, fine, common medium and coarse roots; common fine and medium tubular continuous pores; slightly acid (pH 6.2); clear wavy boundary.

IVC2–38 to 50 inches; brownish yellow (10YR 6/6) extremely gravelly sandy loam, dark yellowish brown (10YR 4/6) moist; massive; soft, loose, non-sticky and non-plastic; 65 percent by volume weathered cinder gravel mainly of the less than 3/4 inch size; many fine, very fine, common medium and few coarse roots; common fine and few medium tubular continuous pores; neutral (pH 6.6); clear wavy boundary.

IVC3–50 to 62 inches; brownish yellow (10YR 6/6) extremely gravelly loamy coarse sand, dark yellowish brown (10YR 4/6) moist; single grained; loose, non-sticky and non-plastic; 75 percent by volume cinder gravel mainly of the 0.2 to 1.2 inch size; few fine, very fine and medium roots; neutral (pH 6.6).

Reference Pedon Location: Siskiyou County, California, about 40 feet upslope of road and about 1650 feet east and 1700 feet north of the SW corner of Section 10, T.43N., R.4E.

Range in Characteristics: Depth to a lithic contact is greater than 30 inches. The mean annual soil temperature at 20 inches is about 38 to 42°F. The soil temperature at the 20 inch depth exceeds 41°F. from July 1 through October 30 and exceeds 47°F. from July 15 through September 25 in most years. The mean summer soil temperature at 20 inches is less than 47°F. The 5 to 15 inch soil moisture control section is usually moist in all parts from November 1 through June 15 and dry in all parts from August 20 through October 10 in most years.

The Lapine family commonly has an approximate 900 year old pumice deposit of up to 24 inches thick. The pumice overburden, if present, consists of an A, or an A-C horizon development in the deeper deposits. If present, the pumice A horizon has dry color of 10YR

5/1, 5/2, 5/3, 6/2, 6/3 and moist color of 10YR 3/2, 3/3, 3/4, 4/2, 4/3 and may be up to 4 inches thick. Texture is coarse sand or coarse loamy sand and contains from 35 to 60 percent by volume pumice gravel. It is single grained and soil pH is medium acid. The pumice overburden C horizon, if present, has dry color of 10YR 7/2, 7/3, 8/2, 8/3 and moist color of 10YR 5/2, 6/2, 6/3, 7/2 or 7/3. Texture is coarse loamy sand or coarse sand and contains from 50 to 90 percent by volume pumice gravel. It is single grained and soil pH is medium acid.

The more weathered cinder material beneath the recent pumice overburden, if present, has an A-C horizon development.

The A horizon is 2 to 5 inches thick with dry color of 10YR 5/3, 5/4; 7.5YR 5/4 and moist color of 10YR 3/3, 3/4, 3/6; 7.5YR 3/4. Texture is coarse sandy loam or sandy loam and contains from 30 to 60 percent by volume weathered cinder gravel. Structure is granular and soil pH is medium to slightly acid.

The C horizon has dry color of 10YR 6/3, 6/4, 6/6, 7/3, 7/4; 7.5YR 6/6 and moist color of 10YR 4/4, 4/6, 5/4, 5/6; 7.5YR 4/6, 5/4, 5/6. Texture is sandy loam, coarse sandy loam, loamy coarse sand or coarse sand and contains from 40 to 90 percent by volume cinder gravel. Some pedons contain gravel, cobble and stone size basalt rock fragments in the 10 to 40 inch control section which can range up to 35 percent by volume. It is massive or single grained and soil pH is medium acid to neutral.

Additional Data: Lincoln Lab. Sample # S79Ca-093-11.

LAWYER FAMILY

The Lawyer family consists of deep and moderately deep, well drained soils that formed in material weathered from volcanic ash and basalt. Permeability is moderately slow. These soils are on basalt plateaus and mountain sideslopes at elevations of 4300 to 6000 feet and have slopes ranging from 1 to 60 percent. The annual precipitation is 16 to 25 inches most of which falls during winter as snow. The mean annual air temperature is 44 to 48°F. The frost free season is 80 to 110 days.

Taxonomic Class: Loamy-skeletal, mixed, mesic, Pachic Ultic Argixerolls.

Reference Pedon: Lawyer family stony loam - on a 7 percent southwest facing basalt plateau at 4400 feet elevation under a ponderosa pine, white fir and incense cedar forest with greenleaf manzanita, bitterbrush, mule ears, Ross's sedge and bunchgrass understory. Soil was dry throughout when described on 10/10/78. (Colors are for dry soil unless otherwise stated.)

01–1 to 0 inches of ponderosa pine, white fir and incense-cedar needles and twigs.

A11–0 to 2 inches; brown (7.5YR 5/4) stony loam, dark reddish brown (5YR 3/2) moist; weak fine platy structure parting to weak fine granular; soft, very friable, slightly sticky, non-plastic; 5 to 10 percent surface stones and 15 percent gravel by volume; common very fine roots; common fine and very fine pores; medium acid (pH 6.0); abrupt smooth boundary.

A12–2 to 8 inches; brown (7.5YR 5/4) cobbly loam, dark reddish brown (5YR 3/3) moist; weak to moderate fine granular structure; soft, friable, slightly sticky, non-plastic; 20 percent gravel and 10 percent cobbles by volume; many very fine and fine and few medium roots; few fine, very fine and medium pores; slightly acid (pH 6.2); clear wavy boundary.

A13–8 to 21 inches; reddish brown (5YR 4/4) very cobbly loam, dark reddish brown (5YR 3/3) moist; weak fine subangular blocky parting to moderate fine granular structure; slightly hard, friable, slightly sticky, slightly plastic; few thin clay films on ped faces; 25 percent cobbles and 20 percent gravel by volume; many very fine and fine, common medium, and few coarse roots; common fine, very fine and medium pores; medium acid (pH 6.0); clear wavy boundary.

B21t–21 to 35 inches; strong brown (7.5YR 4/6), very cobbly clay loam, dark reddish brown (5YR 3/3) moist; moderate medium subangular blocky structure; slightly hard, friable, sticky and slightly plastic; few to common thin clay films on ped faces; 30 percent cobbles and 25 percent gravel by volume; common very fine and fine and few medium roots; common, fine, very fine and medium pores; medium acid (pH 6.0); gradual wavy boundary.

B22t–35 to 50 inches; strong brown (7.5YR 5/6) extremely cobbly clay loam, reddish brown (5YR 4/4) moist; moderate medium subangular blocky structure; slightly hard, slightly firm, sticky and slightly plastic; few to common thin clay films on ped faces; 35 percent cobbles and 30 percent gravel by volume; common very fine, fine and few medium roots; common fine, very fine and medium pores; medium acid (pH 6.0); abrupt wavy boundary.

Cr–50 to 60 inches; highly weathered soft vesicular basalt which can be cut with a spade.

Reference Pedon Location: Modoc County, California, about 50 feet west of road near Lava Camp and about 1600 feet west and 750 feet north of the SE corner of Section 12, T.41N., R.5E.

Range in Characteristics: Depth to bedrock is greater than 40 inches in map units 201, 202, and 203 and 20 to 40 inches in map units 152, 167, 168, 204, 205, 206 and both 20 to 40 and greater than 40 inches in map unit 200. The control section averages 24 to 35% clay content and rock fragments range from 35 to 60% by volume. Base saturation by the ammonium acetate method is estimated to be between 50 to 75 percent throughout the upper 30 inches of the soil. The mean annual soil temperature at a depth of 20 inches is 47 to 52°F. and fluctuates by more than 9°F. during the year. The soil temperature at the 20 inch depth exceeds 41°F. from April 15 through November 30 and exceeds 47°F. from May 1 through November 1 in most years. The 4 to 12 inch soil moisture control section is usually moist in all parts from December 1 through May 15 and dry in all parts from July 15 through October 30.

The A horizon is 12 to 24 inches thick with dry color of 10YR 4/2, 4/3, 4/4, 5/2; 7.5YR 4/2, 4/4, 5/4; 5YR 3/3, 3/4, 4/4 and moist color of 10YR 2/2, 3/2, 3/3; 7.5YR 3/2; 5YR 2.5/2, 3/2, 3/3. Texture is loam and may contain up to 50 percent by volume gravel, cobbles and some stones. Structure is granular or subangular blocky and soil pH is medium acid to neutral.

The B horizon makes up the remaining soil and have

dry color of 10YR 4/3, 4/4, 5/3, 5/6, 6/4; 7.5YR 4/2, 4/4, 4/5, 5/4, 5/6; 5YR 4/4, 5/4, 5/6, 6/4 and moist color of 10YR 3/3, 3/4, 4/4, 5/4; 7.5YR 3/2, 3/4, 4/2, 4/4; 5YR 3/2, 3/3, 3/4, 4/4 or 4/6. The upper part of the argillic B horizon has mollic color and may include the whole soil depth. Texture is loam or clay loam and contains from 35 to 70 percent by volume gravel, cobbles and stones. Structure is prismatic or subangular blocky and soil pH is medium acid to neutral.

LITHIC CRYOCHREPTS

Lithic Cryochrepts consists of shallow, well drained soils derived from hard volcanic tuff conglomerate, andesite or basalt at elevations of 7,300 to 8,000 feet. Permeability is slow. These soils are on mid to upper mountain sideslopes and ridgetops of 10 to 40 percent slope. The climate is cold with a mean annual air temperature of 36 to 40°F. The annual precipitation is 30 to 35 inches and mostly falls as snow in winter. The frost free season is 40 to 70 days.

Taxonomic Class: Lithic Cryochrepts.

Reference Pedon: NOTE: The following pedon description is not necessarily intended to be the modal concept, but only as a reference pedon. Lithic Cryochrepts extremely gravelly clay on a 13 percent west facing windswept mountain ridgetop at 7,350 feet elevation under stunted Phlox sp., vetch, club moss and Idaho fescue rangeland. Soil was dry throughout when described on 9/3/82. (Colors are for dry soil unless otherwise stated.)

A1–0 to 2 inches grayish brown (10YR 5/2) extremely gravelly clay, grayish brown (10YR 5/2) moist; moderate to strong fine angular and subangular blocky structure which parts to strong fine granular; hard, firm, very sticky and very plastic; 90 percent surface gravel and few cobbles which grade to 25 percent gravel by volume at 2 inch depth; many fine, very fine and common medium roots; common to many fine and very fine pores; neutral (pH 7.0); abrupt smooth boundary.

B21t–2 to 13 inches; brown (10YR 5/3) clay, brown (10YR 5/3) moist; strong medium and coarse prismatic structure which parts into strong fine and medium angular blocky structure; very hard; very firm, very sticky and very plastic; common thin clay skins on ped faces and pores; few to common fine and very fine and few medium roots; common fine and very fine pores; slightly acid (pH 6.4); clear smooth boundary.

B3t–13 to 16 inches; light olive brown (2.5Y 5/4) very gravelly clay, olive brown (2.5Y 4/4) moist; strong fine and medium angular blocky structure; very hard, very firm, very sticky and very plastic; common to many thin clay skins on ped faces and pores; 50 percent by volume moderately weathered basalt gravel; very few fine and very fine roots; common very fine pores; neutral (pH 6.6) abrupt smooth boundary.

R–16 plus inches; grayish brown (2.5Y 5/2) to light yellowish brown (2.5Y 6/4) slightly weathered hard fractured basalt bedrock.

Reference Pedon Location: Modoc County, California, about 2100 feet east and 2200 feet south of the NW corner of Section 33, T.44N., R.15E.

Range in Characteristics: Depth to bedrock is 6 to 20 inches. The mean annual soil temperature at the lithic contact is about 38 to 42°F. and the mean summer temperature at the contact is about 50 to 59°F. in most years. The soil temperature at the contact exceeds 41°F. from June 1 through November 15 and exceeds 47°F. from June 15 through October 15 in most years. The 4 to 12 inch soil moisture control section, or to the lithic contact if shallower, is usually moist in all parts from November 1 through June 15 and dry in all parts from August 10 through October 10. The clay content in the control section averages 25 to 60 percent and coarse fragments average 10 to 35 percent by volume.

The A horizon is 2 to 4 inches thick with dry color of 10YR 4/2, 4/3, 5/2, 5/3; 2.5Y 4/2, 5/2, 5/4 and moist color of 10YR 3/3, 3/4, 4/2, 4/3, 5/2; 2.5Y 4/2. Texture is clay loam or clay and contains from 40 to 90 percent surface coarse fragments. Structure is blocky or granular and soil pH is slightly acid to neutral.

The B horizon makes up the remainder of the soil with dry color of 10YR 5/3, 5/4, 6/3, 6/4; 2.5Y 5/2, 5/4, 6/4 and moist color of 10YR 4/3, 4/4, 5/2, 5/3, 5/4; 2.5Y 4/2, 4/4, 5/4. Texture is clay loam or clay and normally contains from 5 to 60 percent by volume coarse fragments and increases with depth. The B horizon shows evidence of illuviated clay, however, the increase in absolute clay content is slight and never reaches a ratio of 1.2:1 from the above horizon. Structure is prismatic or blocky and soil pH is slightly acid to neutral.

LITHIC XERORTHENTS

The Lithic Xerorthents consists of somewhat excessively drained, very shallow and some shallow soils derived from volcanic tuff, basalt, or andesite at elevations of 4,200 to 8,000 feet. Permeability is moderate to rapid. These soils are on volcanic plateaus and sideslopes, ridges and knolls of mountain uplands. Slopes range from 1 to 100 percent. The annual precipitation ranges from 10 to 40 inches most of which falls during the winter as snow. The mean annual air temperature is 38 to 50°F. and the frost free season is 40 to 110 days.

Taxonomic Class: Lithic Xerorthents.

Reference Pedon: NOTE: The following pedon description is not necessarily intended to be the modal concept, but only as a reference pedon. Lithic Xerorthents very cobbly loam on a nearly level volcanic plateau at 4,450 feet elevation under an open and stunted low sagebrush and cheatgrass rangeland. Soil was dry in all parts when described on 8/22/78. (Colors are for dry soil unless otherwise stated.)

A11–0 to 1 inch; brown (10YR 5/3) very cobbly loam, dark yellowish brown (10YR 3/4) moist; weak fine and medium platy structure which parts into weak fine granular; slightly hard, friable, slightly sticky and slightly plastic; 40 percent by volume cobbles and gravel; few to common fine and very fine roots; many fine and medium vesicular pores; neutral (pH 6.8) abrupt smooth boundary.

A12–1 to 5 inches; yellowish brown (10YR 5/4) gravelly loam, brown (10YR 4/3) moist; moderate fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; 15 percent by volume gravel; few to common fine and very fine roots; neutral (pH 6.6) abrupt smooth boundary.

R–5 plus inches; hard volcanic tuff conglomerate.

Reference Pedon Location: Modoc County, California, about 2,200 feet east and 1,700 feet north of the SW corner of Section 20, T.41N., R.7E.

Range in Characteristics: Depth to bedrock is normally 4 to 10 inches, except in soil map unit 209 where it is 10 to 20 inches deep and in map unit 263 where it is 6 to 20 inches deep. The mean annual soil temperature at the lithic contact is about 47 to 53°F. and exceeds 41°F. from about April 1 through December 1 in most years. The soil is usually dry in all parts from June 15 through November 15 and moist in all parts from December 15 through May 1. The average rock fragment content of the control section is 10 to 80 percent and the clay content averages 10 to 40 percent.

The A horizon normally occupies the whole soil depth and have dry color of 10YR 5/2, 5/3, 5/4, 6/2, 6/3, 6/4 and moist color of 10YR 3/4, 3/6, 4/2, 4/3, 4/4. Texture is sandy loam, loamy coarse sand, coarse sandy loam, loam or clay loam and contains from 10 to 80 percent by volume rock fragments. Structure is platy, granular or massive and soil pH is slightly acid to neutral.

The C horizon, if present, has dry color of 10YR 6/2, 6/3, 6/4, 7/3, 7/4; 2.5Y 6/4, 7/2, 7/4 and moist color of 10YR 5/3, 5/4, 5/6, 6/3, 6/4; 2.5Y 5/4, 5/6, 6/4. Texture is loamy coarse sand, coarse sandy loam, sandy loam, loam, clay loam or light clay and contains 5 to 80 percent by volume rock fragments predominately of the gravel and cobble size. It is massive and soil pH is slightly acid to neutral.

LITHIC XERUMBREPTS

The Lithic Xerumbrepts consists of shallow, well-drained soils that formed over hard basalt flow rock. Permeability is moderately rapid. These soils are on relatively recent basalt plateau lava flows at elevations of 4,300 to 5,000 feet and have slopes of 1 to 10 percent. The annual precipitation is 18 to 25 inches most of which falls during winter as snow. The mean annual air temperature is 46 to 48°F. The frost free season is 90 to 110 days.

Taxonomic Class: Lithic Xerumbrepts.

Reference Pedon: NOTE: The following pedon description is not necessarily intended to be the modal concept, but only as a reference pedon. Lithic Xerumbrepts very cobbly sandy loam on a nearly level relatively recent lava flow basalt plateau at 4,340 feet elevation under a sparce ponderosa pine forest with an understory of bitterbrush, rabbitbrush, greenleaf manzanita, currant sp., squaw carpet, bottlebrush and Idaho fescue. Soil was dry throughout when described on 8/27/82. (Colors are for dry soil unless otherwise stated).

01–1/2 to 0 inch; Ponderosa pine, greenleaf manzanita and bitterbrush needles, leaves and twigs.

A11–0 to 4 inches; brown (10YR 5/3) very cobbly sandy loam, very dark grayish brown (10YR 3/2) moist; weak to moderate fine and medium granular structure; soft, soft, slightly sticky and non-plastic; about 30 percent cobbles and 20 percent gravel by volume; many fine, very fine and few to common medium and coarse roots; medium acid (pH 6.0); clear wavy boundary.

A12–4 to 12 inches; yellowish brown (10YR 5/4) extremely cobbly sandy loam, dark brown (10YR 3/3) moist; weak fine and medium granular structure; soft, soft, slightly sticky and non-plastic; 55 percent cobbles and 15 percent gravel by volume; common fine, very fine and few to common medium and coarse roots; slightly acid (pH 6.2).

R–12 plus inches; hard fractured vesicular basalt flow rock.

Reference Pedon Location: Modoc County, California, about 50 feet south of road and about 2,000 feet south and 1,300 feet east of the NW corner of section 22, T.42N., R.5E.

Range in Characteristics: Depth to bedrock is 10 to 20 inches. The mean annual soil temperature at the lithic contact is about 48 to 52°F. and fluctuates by more than 9°F. during the year. The soil temperature at the contact exceeds 41°F. from April 15 through November 30 and exceeds 47°F. from May 1 through November 1 in most years. The 5 to 15 inch soil moisture control section or to the lithic contact, if shallower, is usually moist in all parts from December 1 through May 15 and dry in all parts from July 15 through October 30. Base saturation by the ammonium acetate method is estimated to be between 25 and 50 percent throughout the soil. The soil bulk density is estimated to be between 0.90 and 1.00 gm/cm^3 at 1/3 bar water tension and the ratio of measured clay to 15 bar water is less than 1.25.

The A horizon makes up the whole soil depth with dry color of 10YR 4/3, 4/4, 5/2, 5/3, 5/4 and moist color of 10YR 2/2, 3/2 or 3/3. Texture is sandy loam and rock fragments average 15 to 75 percent by volume in the control section. Structure is granular or subangular blocky and soil pH is medium acid to slightly acid.

LOBERG FAMILY

The Loberg family consists of moderately deep, well drained soils derived from volcanic tuff. Permeability is slow. These soils are on 30 to 60 percent slopes and occur on toeslopes and sideslopes of mountain uplands at 7000 to 8000 feet elevation. The climate is cool with 36 to 40°F mean annual air temperature and 25 to 35 inches annual precipitation which mostly falls during winter. The frost free season is 40 to 70 days.

Taxonomic Class: Clayey-skeletal, mixed, Typic Cryoboralfs.

Reference Pedon: Loberg family gravelly loam on a 35 percent north facing mountain sideslope at 7300 feet elevation under a lodgepole pine and western white pine forest with an understory of prostrate manzanita and few grasses. Soil was moist throughout when described on 10/8/80. (Colors are for dry soil unless otherwise stated.)

01–2 to 0 inches; Lodgepole pine and western white pine needles, twigs and leaf duff mat in a prostrate manzanita carpet.

A1–0 to 7 inches; brown (7.5YR 5/4) gravelly loam, dark brown (7.5YR 3/4) moist; weak fine and medium subangular blocky structure which parts into moderate fine and medium granules; slightly hard, friable, sticky and plastic; 30 percent gravel by volume; many very fine and fine and common medium and coarse roots; many very fine and fine and few medium pores; medium acid (pH 6.0); gradual wavy boundary.

A3–7 to 15 inches; light brown (7.5YR 6/4) very gravelly loam, strong brown (7.5YR 4/6) moist; weak fine and medium subangular blocky structure; slightly hard, friable, sticky and plastic; few thin clay films in pores; 35 percent gravel by volume; common very fine, fine, medium and coarse roots; many very fine and fine and few medium pores; medium acid (pH 5.8); clear smooth boundary.

B21t–15 to 20 inches; light brown (7.5YR 6/4) very gravelly clay loam, strong brown (7.5YR 4/6) moist; moderate fine and medium angular and subangular blocky structure; hard, friable, sticky and plastic; common moderately thick clay films on tubular pores and ped faces; 35 percent gravel by volume; common very fine, fine and medium and few coarse roots; common very fine and fine pores; medium acid (pH 5.8); clear smooth boundary.

B22t–20 to 37 inches; light brown (7.5YR 6/4) very gravelly clay loam, strong brown (7.5YR 4/6) moist; strong fine and medium angular blocky structure; very hard, firm, sticky and plastic; common thick clay films on ped faces; 40 percent gravel by volume; few to common very fine and fine and few medium and coarse roots; few to common very fine and fine pores; medium acid (pH 5.6); gradual wavy boundary.

Cr–37 plus inches; semi-hard weathered conglomerated tuff which can be rubbed to a clay or clay loam.

Reference Pedon Location: Modoc County, California, about 30 feet upslope from road and about 1000 feet south and 2100 feet west of the NE corner of Section 1, T.47N., R.15E.

Range in Characteristics: Depth to the para-lithic contact is 20 to 40 inches. The mean annual soil temperature at the 20 inch depth is about 38 to 42°F. The soil temperature at 20 inches exceeds 41°F. from July 1 through October 30 and exceeds 47°F. from July 20 through September 20 in most years. The mean summer soil temperature at 20 inches is less than 47°F. The 5 to 15 inch soil moisture control section is usually moist in all parts from November 1 through June 15 and dry in all parts from August 15 through October 10. Coarse fragment content of the control section averages 35 to 50 percent and clay content averages 35 to 45 percent.

The A horizon is 6 to 15 inches thick with dry color of 7.5YR 4/4, 4/6, 5/4, 5/6, 6/4; 10YR 5/4, 5/6, 6/2, 6/3, 6/4 and moist color of 7.5YR 3/4, 4/4, 4/6; 10YR 3/4, 4/2, 4/3, 4/4. Texture is loam or silty clay loam with 20 to 45 percent by volume gravel size coarse fragments. Structure is granular or subangular blocky and soil pH is medium acid to slightly acid.

The B horizon makes up the remainder of the soil with dry color of 7.5YR 5/6, 6/4, 6/6; 10YR 5/4, 5/6, 6/4, 6/6; 2.5YR 6/2, 6/4 and moist color of 7.5YR 4/4, 4/6, 5/4, 5/6; 10YR 4/4, 4/6; 2.5YR 4/4, 5/4, 5/6. Texture is clay loam, silty clay loam, clay or silty clay with 35 to 50 percent by volume predominately gravel size coarse fragments. Structure is angular or subangular blocky and soil pH is medium acid to strongly acid.

LOS GATOS FAMILY

The Los Gatos family consists of moderately deep, well drained soils derived from basalt and ash. Permeability is moderate. These soils are on basalt plateaus and mountain sideslopes on 1 to 30 percent slopes. Elevations range from 4300 to 5800 feet. The annual precipitation is 14 to 18 inches most of which falls during the winter as snow. Mean annual air temperature is 44 to 49°F. The frost free season is 80 to 110 days.

Taxonomic Class: Fine-loamy, mixed mesic, Typic Argixerolls.

Reference Pedon: Los Gatos family gravelly loam on a nearly level basalt plateau at 4300 feet elevation under big sagebrush, rabbitbrush and bunchgrass rangeland with few western juniper. Soil was moist below 7 inches when described on 5/15/79. (Colors are for dry soil unless otherwise stated.)

A11–0 to 7 inches; brown (10YR 5/3) gravelly loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable, non-sticky and non-plastic; 15 percent gravel by volume including weathered pumice; common fine, very fine and few medium roots; neutral (pH 6.8); clear smooth boundary.

A12-7 to 19 inches; brown (10YR 5/3) gravelly loam, dark brown (10YR 3/3) moist; weak medium subangular blocky structure parting into weak to moderate fine granular structure; soft, very friable, slightly sticky and slightly plastic; 15 percent gravel by volume; common fine and very fine roots; common fine and very fine tubular pores; neutral (pH 7.0); clear smooth boundary.

B21t–19 to 28 inches; dark yellowish brown (10YR 4/4) clay loam, dark yellowish brown (10YR 3/4) moist; moderate fine and medium subangular blocky structure; hard, friable, sticky and plastic; few thin clay films on ped faces; 5 percent basalt gravel by volume; common very fine and few fine roots; common fine and very fine pores; neutral (pH 6.8); gradual wavy boundary.

B22t–28 to 36 inches; brown (7.5YR 5/4) clay loam, dark brown (7.5YR 4/4) moist; moderate fine and medium subangular blocky structure; hard, friable, sticky and plastic; few to common thin clay films on ped faces; 5 to 10 percent basalt gravel by volume; few fine very fine roots; common fine and very fine tubular pores; neutral (pH 6.8); clear smooth boundary.

B3t–36 to 38 inches; brown (7.5YR 5/4) gravelly clay loam, dark brown (7.5YR 4/4) moist; moderate coarse subangular blocky structure; very hard, friable, sticky and plastic; common thin clay films on ped faces; 15 to 20 percent gravel of basalt by volume; few fine and very fine roots; neutral (pH 6.6).

R–38 plus inches; hard fractured basalt.

Reference Pedon Location: Modoc County, California, about 1700 feet west and 2200 feet south of the NE corner of Section 36, T.45N., R.6E.

Range in Characteristics: Depth to bedrock is 20 to 40 inches. The clay content of the control section averages 20 to 35 percent and up to 35 percent by volume rock fragments may be found but they normally range from 5 to 15 percent. The mean annual soil temperature at a depth of 20 inches is 47 to 52°F. and fluctuates by more than 9°F. during the year. The soil temperature at the 20 inch depth exceeds 41°F. from April 1 through December 1 and exceeds 47°F. from April 15 through November 15 in most years. The 4 to 12 inch soil moisture control section is usually moist in all parts from December 1 through May 1 and dry in all parts from July 1 through October 20.

The A horizon is 7 to 19 inches thick with dry color of 10YR 4/2, 4/3, 4/4, 5/2, 5/3, 5/4; 7.5YR 4/2, 4/4, 5/2, 5/4 and moist color of 10YR 2/2, 3/2, 3/3; 7.5YR 3/2. Texture is loam or sandy loam and coarse fragments may occupy up to 25 percent by volume. Structure is granular or subangular blocky and soil pH is neutral.

The B horizon makes up the remainder of the soil with dry color of 10YR 4/3, 4/4, 5/3, 5/4, 6/3, 6/4; 7.5YR 5/4 and moist color of 10YR 3/3, 3/4, 4/2, 4/3, 4/4; 7.5YR 3/4, 4/2, 4/4. Mollic color occupies the upper 7 to 20 inches of soil and may include the upper parts of the argillic B horizon. Texture is loam or clay loam and rock fragments may make up to 45 percent by volume and generally increase with depth. Structure is subangular blocky and soil pH is neutral.

MANILA FAMILY

The Manila family consists of moderately deep, well drained soils formed from conglomerated volcanic tuff. Permeability is slow. These soils are on 10 to 50 percent slopes and occur on sideslopes, toeslopes and draws of mountain uplands at 5500 to 7000 feet elevation. The climate is cool with 42 to 46°F mean annual air temperature and 20 to 25 inches annual precipitation which mostly falls during winter as snow. The frost free season is 60 to 90 days.

Taxonomic Class: Fine, montmorillonitic, frigid, Typic Argixerolls.

Reference Pedon: Manila family cobbly clay loam on a 10 percent west facing mountain sideslope at 5800 feet elevation under big sagebrush, sedges, Idaho fescue and other bunchgrass rangeland with scattered western juniper. Soil was dry throughout when described on 9/8/80. (Colors are for dry soil unless otherwise stated.)

A1–0 to 4 inches; dark grayish brown (10YR 4/2) cobbly clay loam, very dark brown (10YR 2/2) moist; moderate fine platy structure which parts into strong medium granular; slightly hard, friable, sticky and plastic; 25 percent cobbles and gravel by volume; common very fine and fine and few medium roots; few to common very fine tubular pores; neutral (pH 6.6); clear smooth boundary.

B1t–4 to 8 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine subangular blocky structure which parts into strong medium granular; hard, firm, very sticky and plastic; few to common thin clay films on ped faces; common very fine, fine and medium roots; common to many very fine and fine pores; neutral (pH 6.6); clear smooth boundary.

B21t–8 to 13 inches; dark grayish brown (10YR 4/2) clay loam, dark brown (10YR 3/3) moist; moderate to strong medium angular and subangular blocky structure; hard, firm, very sticky and plastic; common moderately thick clay films on ped faces and pores; common very fine, fine and medium roots; common very fine pores; neutral (pH 6.6); clear smooth boundary.

B22t–13 to 19 inches; grayish brown (10YR 5/2) silty clay, brown (10YR 4/3) moist; strong medium prismatic structure which parts to strong fine and medium subangular blocky; very hard, firm, very sticky and very plastic; many thick clay films on ped faces; 5 percent gravel by volume; few very fine, fine and medium roots; few to common very fine pores; neutral (pH 6.8); clear wavy boundary.

B3t–19 to 27 inches; light olive borwn (2.5Y 5/4) gravelly silty clay, olive brown (2.5Y 4/4) moist; moderate to strong medium and coarse prismatic structure which parts to moderate to strong angular and subangular blocky; hard, firm, very sticky and plastic; common to many thick clay films on ped faces and pores; 30 percent weathered conglomerate tuff gravel by volume; few very fine, fine and coarse roots; few very fine and fine pores; neutral (pH 6.8); clear wavy boundary.

Cr–27 plus inches; light brownish gray (2.5Y 6/2) weathered conglomerated platy tuff with some soil between fractures; common thick clay films on fractured faces; few medium and fine roots between fractures.

Reference Pedon Location: Modoc County, California, about 20 feet east of road and about 1450 feet east and 400 feet north of the SW corner of Section 26, T.42N., R.14E.

Range in Characteristics: Depth to the conglomerated tuff contact is 20 to 40 inches. The mean annual soil temperature at the 20 inch depth is about 44 to 47°F. and fluctuates by more than 9°F. during the year. The soil temperature at 20 inches exceeds 41°F. from May 15 through November 15 and exceeds 47°F. from June 15 through October 15 in most years. The soil 4 to 12 inch soil moisture control section is usually moist in all parts from November 20 through May 15, and dry in all parts from July 20 through October 20. The average coarse fragment content in the control section is 5 to 35 percent by volume and the clay content averages 35 to 50 percent.

The A horizon is 3 to 10 inches thick with dry color of 10YR 4/2, 4/3, 4/4, 5/2, 5/3, 5/4 and moist color of 10YR 2/2, 3/2, 3/3. Texture is loam or clay loam and may contain up to 30 percent by volume coarse fragments. Structure is platy, granular or subangular blocky and soil pH is neutral to slightly acid.

The B horizon makes up the remainder of the soil with

dry clor of 10YR 4/2, 4/3, 5/2, 5/3, 5/4, 6/2, 6/3; 2.5Y 5/2, 5/4 and moist color of 10YR 3/2, 3/3, 3/4, 4/2, 4/3; 2.5Y 4/2, 4/4. Mollic color occupies the upper 7 to 20 inches of soil and normally includes the upper parts of the argillic B horizon. Texture is clay loam, silty clay or clay and may contain up to 40 percent by volume coarse fragments and increases in volume with depth. Structure is prismatic and/or angular or subangular blocky and soil pH is neutral.

MASCAMP FAMILY

The Mascamp family consists of shallow, well drained soils formed from material weathered from andesite, basalt or volcanic tuff. Permeability is moderate. These soils are on mountain sideslopes of 5 to 60 percent slope and at 5500 to 7500 feet elevation. The annual precipitation is 20 to 30 inches which mostly falls during the winter as snow. The mean annual air temperature is 40 to 46°F. The frost free season is 60 to 90 days.

Taxonomic Class: Loamy-skeletal, mixed, frigid, Lithic Argixerolls.

Reference Pedon: Mascamp family very cobbly loam on a 35 percent west facing mountain sideslope at 6300 feet elevation under big sagebrush, bitterbrush, mountain mahogany, Idaho fescue and wheatgrass rangeland with a few scattered western juniper and ponderosa pine. Soil was moist to 6 inches when described on 11/4/81. (Colors are for dry soil unless otherwise noted.)

A1–0 to 6 inches; dark grayish brown (10YR 4/2) very cobbly loam, black (10YR 2/1) moist; moderate fine and medium granular structure; slightly hard, very friable, slightly sticky and slightly plastic; 25 percent gravel and 25 percent cobbles by volume; many very fine and fine and common medium roots; neutral (pH 6.8); gradual wavy boundary.

B1t–6 to 12 inches; dark grayish brown (10YR 4/2) very gravelly loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium subangular blocky structure which parts into moderate fine and medium granular structure; slightly hard, very friable, slightly sticky and slightly plastic; few thin clay films on ped faces and pores; 25 percent gravel and 10 percent cobbles by volume; many very fine and common fine and medium roots; few to common fine and medium tubular pores; neutral (pH 7.0); clear wavy boundary.

B2t–12 to 19 inches; brown (10YR 4/3) very gravelly clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, sticky and plastic; few to common thin clay films on ped faces and pores; 35 percent gravel and 20 percent cobbles by volume; common fine and few to common medium roots; common fine and medium tubular pores; neutral (pH 7.0); abrupt wavy boundary.

R–19 plus inches; hard fractured vesicular basalt.

Reference Pedon Location: Lassen County, California, about 2200 feet east and 750 feet north of the SW corner of Section 3, T.38N., R.11E.

Range in Characteristics: Depth to a lithic contact of fractured basalt, andesite or volcanic tuff is 8 to 20 inches. The mean annual soil temperature at the lithic contact is about 41 to 47°F. and fluctuates by more than 9°F. during the year. The soil temperature at the contact exceeds 41°F. from May 15 through November 15 and exceeds 47°F. from June 15 through October 15 in most years. The 5 to 15 inch soil moisture control section, or to the lithic contact if shallower, is usually moist in all parts from November 20 through May 15, and dry in all parts from July 20 through October 20. The average rock fragment content of the control section is 35 to 60 percent by volume, and also averages 20 to 35 percent clay.

The A horizon is 3 to 9 inches thick with dry color of 10YR 4/2, 4/3, 5/2, 5/3 and moist color of 10YR 2/1, 2/2, 3/2, 3/3. Texture is loam and contains from 10 to 50 percent by volume rock fragments. Structure is granular or subangular blocky and soil pH is neutral to slightly acid.

The B horizon makes up the remainder of the soil with dry color of 10YR 4/2, 4/3, 4/4, 5/3, 5/4; 7.5YR 4/2, 4/4, 5/4 and moist color of 10YR 3/2, 3/3; 7.5YR 3/2. Texture is loam or clay loam and rock fragments occupy 35 to 60 percent by volume. Structure is subangular blocky and soil pH is neutral.

The Menzel family consists of deep, well drained soils formed from basalt, ash and geologically recent pyroclastic pumice. Permeability is rapid in the pumice overburden to moderately rapid below. These soils are on basalt plateaus or plateau scarp breaks with slopes of 1 to 40 percent and at 4200 to 4700 feet elevation. Annual precipitation is 16 to 20 inches which mostly falls during the winter as snow. Annual air temperature is 46 to 48°F. The frost free season is 90 to 110 days.

Taxonomic Class: Coarse-loamy, mixed, mesic, Andic Xerochrepts.

Reference Pedon: Menzel family gravelly coarse sand (pumice overburden) on a nearly level basalt capped plateau under an open ponderosa pine forest with an understory of bitterbrush, rabbitbrush and cheatgrass at 4200 feet elevation. When described on 10/16/79 the soil was dry below the 4 inch depth. (Colors are for dry soil unless otherwise noted).

01–1/2 to 0 inches; ponderosa pine needles and pumice gravel pavement.

A1–0 to 4 inches; grayish brown (10YR 5/2) gravelly coarse sand, very dark gray (10YR 3/1) moist; single grained; loose, nonsticky and nonplastic; 20 percent pumice gravel by volume; many very fine and fine, common medium roots; neutral (pH 6.6) clear smooth boundary.

C1–4 to 14 inches; very pale brown (10YR 8/3) extremely gravelly coarse sand, very pale brown (10YR 7/3) moist; single grained; loose; nonsticky and nonplastic; 75 percent pumice gravel by volume; common very fine and fine and medium few coarse roots; neutral (pH 6.7); abrupt smooth boundary.

IIA1b–14 to 18 inches; yellowish brown (10YR 5/4) gravelly sandy loam, dark yellowish brown (10YR 3/4) moist; weak fine and medium subangular blocky structure which parts into weak to moderate fine granules; soft, very friable, nonsticky and nonplastic; 30 percent weathered cinder gravel by volume; common very fine and fine, medium and coarse roots; many very fine and fine, few medium pores; neutral (pH 6.8); gradual wavy boundary.

IIB21b–18 to 29 inches; yellowish brown (10YR 5/6) gravelly sandy loam, dark yellowish brown (10YR 3/4) moist; weak to moderate medium and coarse subangular blocky structure; slightly hard, very friable, slightly sticky and nonplastic; 30 percent weathered cinder gravel by volume; common very fine, fine medium and coarse roots; many very fine and fine, few medium pores; neutral (pH 6.8); gradual wavy boundary.

IIB22b–29 to 44 inches; brownish yellow (10YR 6/6) gravelly sandy loam, dark yellowish brown (10YR 4/4) moist; weak to moderate medium and coarse subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; 30 percent weathered cinder gravel by volume; few very fine, fine, medium and coarse roots; many fine and fine, common medium pores; slightly acid (pH 6.4); gradual wavy boundary.

IIB3b–44 to 60 inches; brownish yellow (10YR 6/6) very gravelly sandy loam, dark yellowish brown (10YR 3/6) moist; weak medium and coarse subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; 45 percent weathered cinder gravel by volume; common very fine and fine, few medium and coarse roots; common very fine and fine, few medium pores; slightly acid (pH 6.5).

Reference Pedon Location: Modoc County, California; about 450 feet south and 2200 feet west of NE corner of Section 22, T.44N., R.5E.

Range in Characteristics: Depth to a lithic contact of fractured basalt is greater than 40 inches. The mean annual soil temperature at a depth of 20 inches is about 48 to 52°F and fluctuates by more than 9°F during the year. The soil temperature at 20 inches exceeds 41°F from April 15 through November 30 and exceeds 47°F from May 1 through November 1 in most years. The soil between depths of 6 to 18 inches is usually moist in all parts from December 1 through May 15 and dry in all parts from July 15 through October 30. The weighted average content of coarse fragments in the control section is 25 to 35 percent by volume and consists of weathered cinder gravel. The bulk density of the soil fine earth fraction is estimated to be 0.50 to 0.95 at 1/3 bar water tension and the ratio of measured clay to 15 bar water is less than 1.25 throughout the upper 30 inches of soil.

The pumice overburden consists of an approximate 900 year old pumice deposit of 4 to 20 inches which overlies the loamier textured material. This pumice deposit is always less than half the thickness of the

combinded A and B horizons of the underlying soil. The pumice overburden consists of an A or an A-C horizon development in the deeper deposits. The A horizon is 3 to 5 inches thick and has dry color of 10YR 4/2, 4/3, 5/2 or 5/3 and moist color or 10YR 3/1, 3/2, 2/2 or 3/3. Texture is coarse sand or coarse loamy sand and contain 15 to 40 percent by volume pumice gravel mainly of the less than 0.6 inch size. The pumice overburden C horizon has dry color of 10YR 8/2, 8/3, 7/3 or 7/2 and moist color of 10YR 7/3, 7/2 or 6/3. Texture is coarse sand with 70 to 95 percent by volume pumice gravel mainly of the 0.2 to 1.0 inch size. It is single grained and the soil pH of the pumice overburden is slightly acid to neutral.

The loam textured soil beneath the pumice overburden has a A-B horizon development.

The A horizon is 2 to 6 inches thick and has dry color of 10YR 5/2, 5/3, 5/4, 5/6, 6/3 or 7.5YR 5/4 and moist color of 10YR 3/3, 3/4, 4/2, 4/4 or 7.5YR 3/4 or 4/4. Texture is fine sandy loam or sandy loam and contains 20 to 35 percent by volume cinder gravel. Structure is weak subangular blocky and weak to moderate granular. Soil pH is neutral to slightly acid.

The B horizon has dry color of 10YR 5/4, 5/6, 6/4, 6/6 or 7.5YR 5/4 and moist color of 10YR 3/4, 3/6, 4/4, 4/6 or 7.5YR 3/4 or 4/4. Texture is sandy loam or loam with 25 to 50 percent by volume cinder gravel which increases with depth. Structure is weak to moderate subangular blocky. Soil pH ranges from neutral to slightly acid.

Burried C horizon normally is not present.

Additional Data: Lincoln Laboratory, Pedon S79Ca-049-012.

MERKEL FAMILY

The Merkel family consists of moderately deep to deep, well drained soils that formed from basalt, andesite or tuff. Permeability is moderate. These soils are on mountain sideslopes with slopes ranging from 10 to 60 percent. Elevations range from 4800 to 7000 feet. The annual precipitation is 16 to 30 inches most of which falls during the winter as snow. Mean annual air temperature is 40 to 46°F. The frost free season is 60 to 90 days.

Taxonomic Class: Loamy-skeletal, mixed, frigid, Typic Xerochrepts.

Reference Pedon: Merkel family very gravelly loam on a 15 percent west facing mountain sideslope at 6600 feet elevation under a white fir and ponderosa pine forest with a sparce understory of rabbitbrush, Ross's sedge, and bunchgrasses. The soil was dry below 4 inches when described on 8/30/79. (Colors are for dry soil unless otherwise noted.)

01–1 to 0 inches; white fir needles and twigs.

A11–0 to 4 inches; pale brown (10YR 6/3) very gravelly loam, brown (10YR 4/3) moist; weak fine and medium platy structure parting to moderate fine and medium granular; soft, very friable, slightly sticky and slightly plastic; 40 percent gravel by volume; many very fine and fine common medium roots; neutral (pH 6.8); gradual wavy boundary.

A12–4 to 11 inches; pale brown (10YR 6/3) very gravelly loam, dark grayish brown (10YR 4/2) moist; weak fine and medium subangular blocky structure parting to moderate fine and medium granular; soft, very friable, slightly sticky and slightly plastic; 50 percent gravel by volume; many very fine, fine and medium, few coarse roots; common fine pores; neutral (pH 6.8); clear wavy boundary.

B21–11 to 24 inches; pale brown (10YR 6/3) very gravelly loam, brown (10YR 4/3) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, sticky and slightly plastic; 40 percent cobbles and 35 percent gravel by volume; few very fine, fine and coarse and common medium roots; many fine and common medium pores; neutral (pH 6.6); clear wavy boundary.

R–32 plus inches; Hard ashy tuff impregnated with biotite crystals.

Reference Pedon Location: Modoc County, California, about 100 feet upslope of where road terminates and about 1800 feet west and 2400 feet south of NE corner of Section 15, T.39N., R.15E.

Range in Characteristics: Depth to tuff, andesite or basalt is greater than 30 inches. The control section averages 16 to 24 percent clay and coarse fragments average from 35 to 70 percent by volume. The mean annual soil temperature at the 20 inch depth is 42 to 47°F. and fluctuates by more than 9°F. during the year. The soil temperature at the 20 inch depth exceeds 41°F. from June 15 through October 15 in most years. The 5 to 15 inch soil moisture control section is usually moist in all parts from November 15 through May 30 and dry in all parts from August 1 through October 20.

The A horizon is 6 to 12 inches thick with dry color of 10YR 5/3, 5/4, 6/2, 6/3, 6/4 and moist color of 10YR 3/4, 4/2, 4/3, 4/4. Texture is loam or sandy loam and normally contains from 15 to 40 percent by volume coarse fragments. Structure is platy, granular or subangular blocky and soil pH is neutral to slightly acid.

The B horizon normally makes up the remainder of the soil with dry color of 10YR 5/3, 5/4, 5/6, 6/2, 6/3, 6/4; 2.5Y 6/2, 6/3 and moist color of 10YR 4/2, 4/3, 4/4, 5/2, 5/3; 2.5Y 4/2, 4/4. Texture is loam and contains from 35 to 70 percent by volume coarse fragments. Structure is subangular blocky and soil pH is neutral to slightly acid.

MERLIN FAMILY

The Merlin family consists of shallow, well drained soils formed from conglomerated tuff or fractured basalt. Permeability is slow. These soils are on 1 to 70 percent slopes and occur on basalt plateaus, middle to upper sideslopes, knolls, ridges and along eroded drainageways of mountain uplands at 5400 to 7200 feet elevation. The annual precipitation is 20 to 30 inches which falls mostly during the winter as snow. The mean annual air temperature is 40 to 46°F. The frost free season is 60 to 90 days.

Taxonomic Class: Clayey, montmorillonitic, frigid, Lithic Argixerolls.

Reference Pedon: Merlin family very cobbly clay loam on a 16 percent west facing mountain sideslope at 5800 feet elevation under western juniper, low sagebrush, western yarrow and Idaho fescue rangeland. Soil was dry throughout when described on 9/10/80. (Colors are for dry soil unless otherwise stated.)

A1–0 to 2 inches; grayish brown (10YR 5/2) very cobbly clay loam, very dark grayish brown (10YR 3/2) moist; moderate to strong medium and coarse granular structure; slightly hard, friable, sticky and slightly plastic; 25 percent gravel and 20 percent basalt cobbles by volume; many very fine and fine, common medium roots; slightly acid (pH 6.4); clear smooth boundary.

B2t–2 to 9 inches; grayish brown (10YR 5/2) gravelly clay, dark brown (10YR 3/3) moist; strong fine and medium angular blocky structure; very hard, firm, very sticky and plastic; common moderately thick clay films on ped faces and pores; 25 percent basalt gravel by volume; common very fine, fine and medium and few coarse roots; neutral (pH 6.6); clear smooth boundary.

B3t–9 to 12 inches; grayish brown (10YR 5/2) gravelly clay, dark grayish brown (10YR 4/2) moist; strong fine and medium angular blocky structure; very hard, firm, very sticky and very plastic; common to many moderately thick clay films on ped faces and pores; 25 percent basalt and conglomerated tuff gravel by volume; few very fine, fine, medium and coarse roots, neutral (pH 6.6); abrupt smooth boundary.

R–12 plus inches; light gray (2.5YR 7/2) hard conglomerated tuff; thick clay skins on fracture faces; few fine roots between fractures.

Reference Pedon Location: Modoc County, California, about 50 feet east of road and about 1650 feet east and 1000 feet south of the NW corner of Section 30, T.42N., R.15E.

Range of Characteristics: Depth to a lithic contact of fractured basalt or volcanic tuff is 8 to 20 inches. The mean annual soil temperature at the lithic contact is about 41 to 47°F. and fluctuates by more than 9°F. during the year. The soil temperature at the contact exceeds 41°F. from May 15 through November 15 and exceeds 47°F. from June 15 through October 15 in most years. The 4 to 12 inch soil moisture control section, or to the lithic contact if shallower, is usually moist in all parts from November 20 through May 15, and dry in all parts from July 20 through October 20. The average rock fragment content of the control section is 5 to 35 percent by volume, and also averages 35 to 50 percent clay.

The A horizon is 2 to 5 inches thick with dry color of 10YR 4/3, 5/2, 5/3, 5/4 and moist color of 10YR 2/2, 3/2, 3/3. Texture is loam or clay loam. Surface rock fragments normally occupy 15 to 50 percent and consists of cobbles, gravel and some stone size. Structure is granular or subangular blocky and soil pH is slightly acid to neutral.

The B horizon makes up the remainder of the soil with dry color of 10YR 5/2, 5/3, 5/4, 6/3, 6/4 and moist color of 10YR 3/2, 3/3, 3/4, 4/2, 4/3. Mollic color occupies at least the upper 7 inches of soil and may include the whole soil depth. Texture is clay loam or clay. Structure is angular or subangular blocky and soil pH is neutral to slightly acid.

NEER FAMILY

The Neer family consists of moderately deep and deep, well drained soils formed in material weathered from volcanic ash material and geologically recent pyrolastic pumice. Permeability is rapid in the pumice overburden to moderately rapid below. These soils are found on basalt plateaus and on volcanic mountain uplands with 10 to 30 percent slopes at 4400 to 5300 feet elevation. The annual precipitation is 16 to 25 inches, most of which falls during winter as snow. The mean annual air temperature is 45 to 49°F. The frost free season is 90 to 110 days.

Taxonomic Class: Medial-skeletal, mesic, Andic Xerochrepts.

Reference Pedon: Neer family gravelly loamy coarse sand on a 10 percent east facing slope on a basalt plateau at 4520 feet elevation under a ponderosa pine forest with an understory of bitterbrush and rabbitbrush. Soil was dry throughout when described on 10/16/71. (Colors are for dry soil unless otherwise stated.)

01–1 to 0 inches; Ponderosa pine needles and twigs, mixed with pumice gravels.

A1–0 to 5 inches; grayish brown (10YR 5/2) gravelly loamy coarse sand very dark grayish brown (10YR 3/2) moist; single grained; loose, non-sticky and non-plastic; 30 percent pumice gravel by volume; common fine and very fine and few to common medium and coarse roots; neutral (pH 6.6); clear smooth boundary.

C1–5 to 18 inches; very pale brown (10YR 8/3) extremely gravelly coarse sand, very pale brown (10YR 7/3) moist; single grained; loose, non-sticky and non-plastic; 70 percent pumice gravel; few to common fine and very fine and few medium and coarse roots; neutral (pH 6.8); abrupt smooth boundary.

IIA1b–18 to 22 inches; yellowish brown (10YR 5/4) very gravelly sandy loam, dark yellowish brown (10YR 4/4) moist; weak fine and medium granular structure; slightly hard, very friable, non-sticky and non-plastic; 30 percent gravel and 10 percent cobbles of mixed weathered cinders, basalt and obsidian by volume; common very fine and fine and few medium and coarse roots; common very fine and fine tubular pores; neutral (pH 6.8); clear smooth boundary.

IIB21b–22 to 28 inches; yellowish brown (10YR 5/4) very cobbly sandy loam, dark yellowish brown (10YR 4/4) moist; weak medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; 40 to 50 percent basalt and obsidian cobbles and gravel by volume; common very fine and fine and few medium roots; common to many very fine and fine tubular pores; neutral (pH 6.8); gradual wavy boundary.

IIB22b–28 to 38 inches; light yellowish brown (10YR 6/4) extremely cobbly coarse sandy loam, dark yellowish brown (10YR 4/4) moist; weak medium subangular blocky structure; soft, very friable, non-sticky and non-plastic; 60 percent basalt and obsidian cobbles and gravel by volume; few to common very fine, fine and medium roots; neutral (pH 6.6); clear wavy boundary.

IIB3b–38 to 60 inches; light yellowish brown (10YR 6/4) extremely cobbly coarse sandy loam, dark yellowish brown (10YR 4/6) moist; weak medium and coarse subangular blocky structure; soft, very friable, non-sticky and non-plastic; 70 to 80 percent basalt and obsidian cobbles, gravel and few stones by volume; few fine, very fine and medium roots; neutral (pH 6.6).

Reference Pedon Location: Modoc County, California, about 1800 feet west and 1400 feet south of the NE corner of Section 20, T.44N., R.5E.

Range in Characteristics: Depth to a lithic contact is greater than 30 inches. Rock fragments in the control section average 35 to 70 percent by volume and are predominately basalt, obsidian and weathered cinder cobbles and gravel. The mean annual soil temperature at a depth of 20 inches is about 47 to 52°F. and fluctuates by more than 9°F. during the year. The soil temperature at 20 inches exceeds 41°F. from April 15 through November 30 and exceeds 47°F from May 1 through November 1 in most years. The 5 to 15 inch soil moisture control section is usually moist in all parts from December 1 through May 15 and dry in all parts from July 15 through October 30.

The Neer family in this survey has an approximate 900 year old pumice deposit of 10 to 20 inches in depth. This pumice deposit is always less than half the thickness of the underlying combined A and B horizons. The pumice overburden consists of an A-C horizon development.

The pumice A horizon is 4 to 6 inches thick with dry color of 10YR 5/2, 5/3, 5/4, 6/2, 6/3 and moist color of 10YR 3/2, 3/3, 3/4, 4/2. Texture is coarse loamy sand or coarse sandy loam and contains from 30 to 50 percent by volume pumice gravel mainly of the less than 0.6 inch size. It is single grained and soil pH is slightly acid to neutral. The pumice C horizon has dry color of 10YR 7/2, 7/3, 8/2, 8/3 and moist color of 10YR 6/2, 6/3, 7/2 or 7/3. Texture is coarse loamy sand or coarse sand and contains from 60 to 90 percent by volume pumice gravel mainly of the 0.2 to 1.0 inch size. It is single grained and soil pH is neutral to slightly acid.

The loamy textured soil beneath the pumice overburden has an A-B horizon development.

The A horizon is 3 to 8 inches thick with dry color of 10YR 5/3, 5/4, 5/6, 6/2, 6/3 and moist color of 10YR 3/4, 3/6, 4/2, 4/3, 4/4. Texture is sandy loam or loam and contains from 20 to 50 percent by volume weathered cinders and gravel and cobble size basalt and obsidian. Structure is granular and soil pH is slightly acid to neutral.

The B horizon has dry color of 10YR 5/4, 6/3, 6/4, 6/6 and moist color of 10YR 4/2, 4/3, 4/4, 4/6, 5/3, 5/4. Texture is sandy loam, loam, coarse sandy loam, or coarse loamy sand and contains from 35 to 80 percent by volume rock fragments. Structure is subangular blocky or massive and soil pH is slightly acid to neutral.

PACKWOOD FAMILY

The Packwood family consists of shallow, well drained soils that formed in material derived from volcanic ash or basalt. These soils overlay a strongly cemented to indurated silica duripan at 7 to 20 inch depth. Permeability is slow. These soils are on 1 to 10 percent slopes and occur on slightly concave areas as well as intermound areas between 10 to 30 foot diameter mounds on basalt plateaus at 4400 to 5800 feet elevation. Annual precipitation is 12 to 18 inches most of which falls during winter as snow. Mean annual air temperature is 44 to 48°F. The frost free season is 80 to 110 days.

Taxonomic Class: Loamy, mixed, mesic, shallow, Xerollic Durargids.

Reference Pedon: Packwood family very stony loam on a nearly level basalt plateau under rangeland. (Colors are for dry soil unless otherwise stated.)

A11–0 to 2 inches; light yellowish brown (10YR 6/4) very stony loam, brown (7.5YR 4/4) moist; weak medium and thick platy structure; slightly hard, very friable, slightly sticky, slightly plastic; few very fine roots; common very fine interstitial, few very fine tubular, and common very fine and fine vesicular pores; 20 percent basalt stones by volume and 20 percent cobbles and gravel on surface; slightly acid (pH 6.5); clear smooth boundary.

A12–2 to 5 inches; light yellowish brown (10YR 6/4) loam, brown (7.5YR 4/4) moist; weak medium subangular blocky structure; hard, very friable, slightly sticky, slightly plastic; few very fine roots; common very fine interstitial and few very fine tubular pores; few thin clay films as bridges of mineral grains; slightly acid (pH 6.2); clear smooth boundary.

B2t–5 to 8 inches; dark brown (7.5YR 4/4) light clay loam, dark reddish brown (5YR 3/4) moist; weak medium and coarse subangular blocky structure; hard, very friable, sticky and plastic; few very fine roots; few very fine tubular and interstitial pores; common moderately thick clay films on peds and in pores; neutral (pH 7.0); abrupt smooth boundary.

C1sim–8 to 11 inches; yellow (10YR 7/6) silica duripan, yellowish brown (7.5YR 5/6) moist; strong medium and thick platy structure with 0.5 mm thick laminar silica and clay plates, reddish yellow (5YR 6/8) and yellowish red (5YR 4/8) moist; very hard; few very fine horizontal roots on plate surfaces; strongly cemented; abrupt smooth boundary.

C2sicam–11 to 16 inches; brown (10YR 5/3) silica duripan, dark yellowish brown (10YR 4/4) moist; massive parting to weak medium and thick plates; very hard, strongly cemented; slightly effervescent with fine irregular line in seams; abrupt smooth boundary.

R–16 plus inches; dark gray (N 4/) hard, fractured basalt.

Reference Pedon Location: Modoc County, California; about 11.4 miles north of Modoc National Forest Boundary on Crowder Flat Road or 2000 feet north from Whitemore Springs Road and 100 feet west of Crowder Flat Road in the NE 1/4 of NW 1/4, Section 16, T.44N., R.11E. (State model)

Range in Characteristics: Depth to the silica duripan ranges from 7 to 20 inches. The silica duripan is generally only a few millimeters to a foot in thickness and is underlain by basalt or volcanic tuff. The control section averages 25 to 35 percent clay. The mean annual soil temperature at the silica duripan contact is about 47 to 52°F. and fluctuates by more than 9°F. during the year. The soil temperature at the contact exceeds 41°F. from April 1 through December 1 in most years. The soils 4 to 12 inch moisture control section, or to the contact if shallower, is usually dry in all parts from June 15 through November 15, and moist in all parts from December 15 through May 1.

The A horizons are 2 to 6 inches thick with dry color of 10YR 5/4, 6/2, 6/3, 6/4; 7.5YR 5/4 and moist color of 10YR 3/4, 4/2, 4/3, 4/4; 7.5YR 3/4, 4/2, 4/4; 5YR 3/4. Texture is loam or fine sandy loam and normally contains from 20 to 60 percent surface cobble, stone and gravel size rock fragments. Structure is platy, granular or subangular blocky and soil pH is slightly acid to neutral.

The B horizons have dry color of 10YR 5/3, 5/4, 5/6, 6/3, 6/4; 7.5YR 4/4, 4/6, 5/4, 5/6; 5YR 4/4, 5/3, 5/4 and moist color of 10YR 3/4, 4/3, 4/4, 5/4; 7.5YR 3/4, 4/4, 4/6; 5YR 3/4, 4/3, 4/4. Texture is clay loam or clay and normally contains 0 to 10 percent by volume rock fragments. Structure is subangular and angular blocky and soil pH is neutral to slightly acid.

The Csim horizons are massive or platy and are strongly cemented or indurated.

Additional Data: Riverside Laboratory, Pedon No. S73 Ca-25-1.

PASS CANYON FAMILY

The Pass Canyon family consists of shallow, well drained soils that formed from basalt, andesite or volcanic tuff. Permeability is moderately slow. The soils are on 1 to 70 percent slopes and occur on basalt plateaus and sideslopes, ridges and knolls of mountain uplands at 4300 to 6000 feet elevation. Annual precipitation is 10 to 20 inches, and mostly falls as snow during winter. The mean annual air temperature is 44 to 48°F. The frost free season is 80 to 110 days.

Taxonomic Class: Loamy, mixed, mesic, Lithic Argixerolls.

Reference Pedon: Pass Canyon family very cobbly loam on a 7 percent west facing sideslope on an undulating basalt plateau at 4980 foot elevation under western juniper, low sagebrush, and bunchgrass rangeland. Soil was moist throughout when described on 4/16/80. (Colors are for dry soil unless otherwise stated.)

A11–0 to 2 inches; dark grayish brown (10YR 4/2) very cobbly loam, very dark brown (10YR 2/2) moist; moderate very fine and fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; 35 percent cobbles and stones and 20 percent gravel by volume, many very fine and fine, and few to common medium roots; neutral (pH 6.8); clear smooth boundary.

A12-2 to 4 inches; dark grayish brown (10YR 4/3) loam, dark brown (7.5YR 3/2) moist; weak to moderate fine and medium platy structure which parts into moderate fine granular; hard, friable, sticky and plastic; 5 to 10 percent basalt cobbles and 5 percent gravel by volume; common to many very fine and fine and common medium and coarse roots; common to many very fine and fine tubular continuous pores; neutral (pH 6.6); gradual wavy boundary.

B21t–4 to 9 inches; brown (7.5YR 4/4) clay loam, dark reddish brown (5YR 3/3) moist; moderate fine and medium subangular blocky structure; hard, friable, sticky and plastic; few thin clay films on ped faces; 10 percent basalt cobbles and less than 5 percent gravel by volume; common very fine, fine, medium and coarse roots; many very fine and fine and common medium tubular continuous pores; neutral (pH 6.6); clear wavy boundary.

B22t–9 to 12 inches; brown (7.5YR 4/4) cobbly clay loam, dark reddish brown (5YR 3/3) moist; moderate fine and medium subangular and angular blocky structure; hard, friable, very sticky and plastic; few to common thick clay films on ped faces and pores; 25 percent basalt cobbles and gravel by volume; common very fine, fine medium and coarse roots; common very fine and fine, few medium tubular continuous pores; neutral (pH 6.6); abrupt wavy boundary.

R–12 plus inches; hard fractured basalt.

Reference Pedon Location: Modoc County, California, about 100 feet north of road and about 950 feet west and 2400 feet north of the SE corner of Section 12, T.46N., R.9E.

Range in Characteristics: Depth to a lithic contact of basalt, andesite or volcanic tuff is 8 to 20 inches. In some areas where Pass Canyon has been mapped, notably in the south central portion of the survey area, much of it is over a softer type volcanic tuff which may be cut with a shovel. Clay content in the control section averages 22 to 35 percent and coarse fragments may occupy up to 35 percent by volume. The mean annual soil temperature at the lithic contact is about 47 to 52°F. and fluctuates by more than 9°F. during the year. The soil temperature at the contact is greater than 41°F. from April 1 through December 1. Where this soil is mapped with map units 153, 221, 229, and 243 the 4 to 12 inch soil moisture control section, or to the lithic contact if shallower, is usually dry in all parts from June 15 through November 15, and moist in all parts from December 15 through May 1. Where this soil is mapped in other map units the soil moisture control section is usually dry in all parts from July 1 through October 30, and moist in all parts from December 1 through May 1.

The A horizons are 2 to 5 inches thick with dry color of 10YR 4/2, 4/3, 5/2, 5/3, 5/4; 7.5YR 4/4, 5/2, 5/4 and moist color of 10YR 2/2, 3/2, 3/3; 7.5YR 3/2. Texture is loam and normally contains 15 to 60 percent cobble, stone and gravel size surface rock fragments. Structure is granular of platy and soil pH is neutral to slightly acid.

The B horizons have dry color of 10YR 4/3, 4/4, 5/3, 5/4; 7.5YR 4/4, 5/4; 5YR 4/3, 4/4, 5/3 and moist color of 10YR 3/2, 3/3, 3/4; 7.5YR 3/2, 3/3. The upper 7 inches of soil have mollic color and commonly includes the whole soil depth. Texture is loam or clay loam and contains up to 35 percent coarse fragments in some pedons. Structure is angular or subangular blocky and soil pH is neutral to slightly acid.

PATIO FAMILY

The Patio family consists of moderately deep and deep, well drained soils that formed in material derived from basalt and andesite. Permeability is moderate. These soils are on mountain sideslopes of 15 to 80 percent slopes. Elevation ranges from 4800 to 7200 feet. The annual precipitation is 16 to 30 inches, most of which falls during the winter as snow. The mean annual air temperature is 40 to 46°F. Frost-free season is 60 to 90 days.

Taxonomic Class: Loamy-skeletal, mixed, frigid, Ultic Haploxerolls.

Reference Pedon: Patio family very gravelly loam on a 50 percent northwest facing mountain sideslope at 6770 foot elevation under a white fir forest with a sparce understory of current sp. and bunchgrass. Soil was moist below 24 inches when described on 8/30/79. (Colors are for dry soil unless otherwise noted.)

01–1 to 0 inches; white fir needles and twigs.

A11–0 to 9 inches; yellowish brown (10YR 5/4) very gravelly loam, dark brown (10YR 3/3) moist; moderate fine and very fine granular structure; slightly hard, friable, slightly sticky and non-plastic; 45 percent basalt gravel by volume; many very fine, fine and medium and common coarse roots; neutral (pH 6.8); gradual wavy boundary.

A12–9 to 18 inches; yellowish brown (10YR 5/4) very gravelly loam, dark brown (10YR 3/3) moist; moderate fine and very fine granular structure; slightly hard, friable, slightly sticky and non-plastic; 50 percent gravel and 5 percent cobbles of basalt by volume; many fine, very fine, medium and coarse roots; slightly acid (pH 6.2); gradual wavy boundary.

B21–18 to 33 inches; pale brown (10YR 6/3) extremely gravelly loam, brown (10YR 4/3) moist; moderate fine subangular blocky structure parting to weak to moderate fine and very fine granular; slightly hard, friable, slightly sticky and non-plastic; 60 percent gravel and 15 percent cobbles of basalt by volume; many fine, very fine and common medium and coarse roots; medium acid (pH 6.0); gradual wavy boundary.

B22–33 to 60 inches; light yellowish brown (10YR 6/4) extremely cobbly loam, brown (10YR 4/3) moist; weak to moderate medium subangular blocky structure; slightly hard, friable, sticky and slightly plastic; 40 percent cobbles and stones and 40 percent gravel of basalt by volume; many fine, very fine and common medium and coarse roots; medium acid (pH 5.8).

Reference Pedon Location: Modoc County, California; about 40 feet upslope from road and about 1000 feet west and 1600 feet north of the SE corner of Section 22, T.39N., R.15E.

Range in Characteristics: Depth to bedrock is 20 to 40 inches in soil map units 114 and 233, and is greater than 40 inches in other map units. The control section averages 14 to 24 percent clay and coarse fragments average 35 to 75 percent by volume. Base saturation by the ammonium acetate method is estimated to be between 50 and 75 percent normally throughout the whole soil depth. The mean annual soil temperature at a depth of 20 inches is 41 to 47°F. and fluctuates by more than 9°F. during the year. The soil temperature at the 20 inch depth exceeds 41°F. from May 15 through November 15 and exceeds 47°F. from June 15 through October 15 in most years. The 5 to 15 inch soil moisture control section is usually moist in all parts from November 15 through May 30 and dry in all parts from August 1 through October 20.

The A horizons are 7 to 20 inches thick with dry color of 10YR 4/2, 4/3, 4/4, 5/3, 5/4; 7.5YR 4/4, 5/4 and moist color of 10YR 3/2, 3/3; 7.5YR 3/2; 5YR 3/2, 3/3. Texture is loam or sandy loam and contains from 20 to 60 percent by volume coarse fragments mainly of the gravel size. Structure is granular or subangular blocky and soil pH is neutral to medium acid.

The B horizons make up the remainder of the soil with dry color of 10YR 5/3, 5/4, 6/2, 6/3, 6/4; 7.5YR 5/4, 6/2, 6/4; 5YR 5/3, 5/4 and moist color of 10YR 3/4, 4/2, 4/3, 4/4; 7.5YR 3/4, 4/4, 4/6; 5YR 3/4, 4/3, 4/4. Texture is loam or sandy loam and contains from 35 to 80 percent by volume rock fragments mainly of the gravel and cobble size with few stones. Structure is subangular blocky and soil pH is slightly acid to medium acid.

PULS FAMILY

The Puls family consists of shallow, well drained soils that have formed in material derived from volcanic ash or basalt. These soils overlie a silica duripan at a depth of 10 to 20 inches. Permeability is very slow. Puls soils are on basalt plateaus of 0 to 10 percent slopes at elevations of 4300 to 5800 feet. Annual precipitation is 12 to 16 inches most of which falls in winter as snow. Mean annual air temperature is 44 to 48°F. The frost free season is 80 to 110 days.

Taxonomic Class: Clayey, montmorillonitic, mesic, shallow, Abruptic Xerollic Duragids.

Reference Pedon: Puls family very stony clay loam on a nearly level basalt plateau at 5100 foot elevation under low sagebrush, sedges, cheatgrass and other bunchgrass rangeland. (Colors are for dry soil unless otherwise stated.)

A1–0 to 5 inches; pinkish gray (7.5YR 6/2) very stony clay loam, brown (7.5YR 4/2) moist; weak coarse granular structure; slightly hard, friable, sticky and plastic; common very fine roots; common very fine interstitial pores and very few very fine tubular pores; 15 percent stones and 20 percent cobbles, by volume, on the surface; slightly acid (pH 6.3); clear smooth boundary.

B1–5 to 9 inches; reddish brown (5YR 5/3) clay loam, dark reddish brown (5YR 3/4) moist; weak medium subangular blocky structure; hard, friable, sticky and plastic; few very fine roots; common very fine interstitial pores and few very fine tubular pores; 5 percent gravel and cobbles, by volume; slightly acid (pH 6.3); abrupt smooth boundary.

B2t–9 to 19 inches; dark reddish brown (5YR 3/3) clay, dark reddish brown (5YR 3/3) moist; strong coarse prismatic structure; very hard, extremely firm, sticky and very plastic; lower 1 inch is weakly cemented; roots on peds; few very fine interstitial and few very fine tubular pores; continuous thick clay films on peds and in pores; slightly acid (pH 6.3); clear smooth boundary.

C1sim–19 to 24 inches; reddish yellow (7.5YR 7/6) indurated silica- cemented duripan that has common medium distinct very dark gray (N 3/0) manganese mottles; massive; slightly acid (pH 6.3); abrupt smooth boundary.

C2sim–24 to 28 inches; reddish brown (5YR 4/4) indurated silica-cemented duripan that has common medium distinct very dark gray (N 3/0) manganese mottles; 10 percent rounded obsidian gravel, by volume.

R–28 inches; hard fractured basalt.

Reference Pedon Location: Modoc County, California, about 100 feet east of the center of old U.S. Highway 395, 0.24 miles northeast from the junction with a dirt road that leads south to willow Ranch NE1/4NE1/4, Seciton 3, T.46N., R.14E.

Range in Characteristics: Depth to the silica duripan is 10 to 20 inches. Generally the duripan is only a few millimeters to two feet in thickness over hard fractured basalt. Clay content in the control section averages 40 to 60 percent. The mean annual soil temperature at the contact is about 47 to 52°F. and fluctuates by more than 9°F. during the year. The soil temperature at the duripan contact exceeds 41°F. from April 1 through December 1 in most years. The 4 to 12 inch soil moisture control section, or to the duripan contact if shallower, is usually dry in all parts from June 15 through November 15, and moist in all parts from December 15 through May 1.

The A horizons are 2 to 5 inches thick with dry color of 10YR 5/4, 6/2, 6/3; 7.5YR 5/4, 6/4, 6/2 and moist color of 10YR 3/4, 4/3, 4/4; 7.5YR 3/4, 4/4, 4/2. Texture is loam or light clay loam and normally contains from 25 to 60 percent surface rock fragments of cobbles, gravel and stones. Structure is platy, granular or subangular blocky and soil pH is medium acid to neutral.

The B horizons have dry color of 10YR 5/4, 5/6, 6/6; 7.5YR 4/4, 5/4, 5/6, 6/6; 5YR 3/3, 3/4, 5/3 and moist color of 10YR 4/4, 4/6; 7.5YR 3/4, 4/4, 4/6; 5YR 3/4, 3/3, or 4/4. Texture is clay or clay loam and generally contains 0 to 10 percent by volume coarse fragments. Structure is primatic or angular blocky and soil pH is slightly acid to mildly alkaline.

The Csim is platy to massive and strongly cemented or indurated and may have opal coated laminar plates cemented in a mosaic.

RIDD FAMILY

The Ridd family consists of moderately deep, well drained soils that formed from basalt and andesite. Permeability is moderately slow. These soils are on 1 to 35 percent slopes of basalt plateaus and mountain uplands at 4400 to 5800 feet elevation. The annual precipitation is 14 to 18 inches which mostly falls during winter as snow. Mean annual air temperature is 44 to 48°F. and the frost-free season is 80 to 110 days.

Taxonomic Class: Loamy-skeletal, mixed, mesic, Typic Argixerolls.

Reference Pedon: Ridd family, cobbly loam on a 20 percent west facing sideslope at 5320 feet elevation under big sagebrush, rabbitbrush and bunchgrass rangeland. Soil was dry throughout when described on 9/25/79. (Colors are for dry soil unless otherwise stated.)

A1–0 to 5 inches; dark grayish brown (10YR 4/2) cobbly loam, very dark brown (10YR 2/2) moist; moderate fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; common fine, very fine and few medium roots; 15 percent basalt cobbles and 15 percent gravel by volume; medium acid (pH 6.0) clear wavy boundary.

B1t–5 to 12 inches; brown (10YR 4/3) very cobbly clay loam, very dark grayish brown (10YR 3/2) moist; weak to moderate fine and medium subangular blocky structure parting to moderate fine granular; slightly hard, friable, sticky and slightly plastic; few thin clay films on ped faces; 25 percent gravel and 15 percent cobbles by volume; common fine, fine, very fine and few medium and coarse roots; common fine and very fine pores; slightly acid (pH 6.2) clear smooth boundary.

B2t–12 to 18 inches; brown (10YR 5/3) very cobbly clay loam, dark brown (10YR 3/3) moist; moderate fine and medium subangular blocky structure; hard, friable, sticky and plastic; common thin clay films on ped faces and pores; 15 percent cobbles and stones and 25 percent gravel by volume; common fine and very fine and few medium roots; common fine and very fine pores; neutral (pH 6.8) clear smooth boundary.

B22t–18 to 37 inches; light yellowish brown (10YR 6/4) very cobbly clay loam, dark yellowish brown (10YR 4/4) moist; moderate to strong fine and medium subangular blocky structure; hard, friable, sticky and plastic; common thick clay films on ped faces and pores; 20 percent cobbles and stones and 30 percent gravel by volume; few fine, medium and very fine roots; few to common fine and very fine pores; neutral (pH 6.8).

R–37 plus inches; hard fractured andesite.

Reference Pedon Location: Modoc County, California, about 40 feet east of road and about 1100 feet east and 1550 feet north of the SW corner of Section 15, T.46N., R.14E.

Range in Characteristics: Depth to bedrock is 20 to 40 inches. Clay content in the control section averages 24 to 35 percent and rock fragments average 35 to 60 percent by volume. The mean annual soil temperature at a depth of 20 inches is about 47 to 52°F. and fluctuates by more than 9°F. during the year. The soil temperature at the 20 inch depth exceeds 41°F. from April 1 through December 1 and exceeds 47°F. from April 15 through November 15 in most years. The 5 to 15 inch soil moisture control section is usually moist in all parts from December 1 through May 1 and dry in all parts from July 1 through October 30.

The A horizon is 4 to 12 inches thick with dry color of 10YR 4/2, 4/3, 5/2, 5/3, 5/4 and moist color of 10YR 2/2, 3/2, 3/3; 7.5YR 3/2. Texture is loam and contains from 20 to 50 percent by volume gravel, cobbles and some stones. Structure is granular or subangular blocky and soil pH is medium acid to neutral.

The B horizon makes up the remainder of the soil with dry color of 10YR 4/3, 5/3, 5/4, 6/3, 6/4; 7/5YR 4/4, 5/4 and moist color of 10YR 3/2. 3/3, 3/4, 4/3, 4/4; 7.5YR 3/2, 3/4, 4/4. Mollic color occupies the upper 10 to 20 inches of the soil and normally include the upper parts of the argillic B horizon. Texture is loam or clay loam and contains 35 to 70 percent by volume rock fragments. Structure is subangular blocky and soil pH is slightly acid to neutral.

The Roval family consists of shallow, well drained soils with a silica duripan formed over basalt. Permeability is slow. These soils are on 1 to 15 percent slopes and occur on volcanic plateaus at 4500 to 6000 feet elevation. The climate is cool with 14 to 16 inches annual precipitation which mostly falls during winter as snow. The mean annual air temperature ranges from 44 to 48°F. The frost free season is 80 to 110 days.

Taxonomic Class: Loamy, mixed, mesic, shallow, Aridic Durixerolls.

Reference Pedon: Roval family very cobbly loam on a nearly level basalt plateau at 5080 feet elevation under low sagebrush, phlox spp., sandberg bluegrass and cheatgrass rangeland. Soil was moist throughout when described on 4/11/80. (Colors are for dry soil unless otherwise stated.)

A1–0 to 2 inches; brown (7.5YR 4/4) very cobbly loam, dark reddish brown (5YR 3/3) moist; weak medium platy structure which parts into moderate very fine and fine granular; slightly hard, very friable, slightly sticky and slightly plastic; 55 to 60 percent cobbles and gravel by volume; many very fine and fine and few medium roots; many medium vesicular pores; neutral (pH 6.6); clear smooth boundary.

B21t–2 to 7 inches; brown (7.5YR 4/4) clay loam, dark reddish brown (5YR 3/3) moist; weak to moderate fine subangular blocky structure which parts into moderate fine granular; hard, friable, sticky and plastic; few to common thin clay films on ped faces; common very fine and fine and few medium roots; few to common very fine and fine pores; neutral (pH 6.8) gradual wavy boundary.

B22t–7 to 10 inches; brown (7.5YR 5/4) clay loam, dark reddish brown (5YR 3/3) moist; moderate fine and medium subangular blocky structure; hard, friable, sticky and plastic; common moderately thick clay films on ped faces; common very fine and fine and few medium roots; common to many very fine and fine and few medium pores; neutral (pH 6.7); clear smooth boundary.

B3tsi–10 to 13 inches; brown (7.5YR 4/4) clay, dark brown (7.5YR 3/4) moist; moderate to strong fine angular blocky structure; very hard, firm, very sticky and very plastic; many moderately thick clay films on ped faces; few fine and medium masses of a silica deposit; 10 to 15 percent cobbles and gravel by volume; few to common very fine and fine roots; common very fine and few fine and medium pores; neutral (pH 6.6); abrupt smooth boundary.

Csim–13 to 14 inches; strongly cemented silica duripan.

R–14 plus inches; hard fractured basalt.

Reference Pedon Location: Modoc County, California, about 200 feet north of road and about 600 feet east and 500 feet north of the SW corner of Section 7, T.45N., R.11E.

Range in Characteristics: Depth to silica duripan ranges from 10 to 20 inches. The silica duripan is generally only a few millimeters to a foot in thickness and is underlain by basalt or volcanic tuff. The control section averages 25 to 35 percent clay. The mean annual soil temperature at the contact is about 46 to 52°F. and fluctuates by more then 9°F. during the year. The soil temperature at the duripan contact exceeds 41°F. from April 1 through December 1. The 4 to 12 inch soil moisture control section, or to the duripan contact if shallower, is usually dry in all parts from June 15 through November 15, and moist in all parts from December 15 through May 1.

The A horizon is 2 to 6 inches thick with dry color of 10YR 4/2, 4/3, 5/2, 5/3, 5/4 or 7.5YR 4/2, 5/2 amd moist color of 10YR 2/2, 3/2, 3/3 or 7.5YR 3/2. Texture is loam and normally contain between 20 to 80 percent surface basalt rock fragments of cobbles, gravel and stones. Structure is platy,granular or blocky and soil pH is neutral to slightly acid.

The B horizon has dry color of 10YR 4/3, 4/4, 5/3, 5/4, 6/3, 6/4; 7.5YR 4/4, 5/4, 5/6, 6/4 and moist colors of 10YR 3/2, 3/3, 3/4, 4/3; 7.5YR 3/2, 3/4, 4/4, 4/5; 5YR 3/2 or 3/3. The upper part of the agrillic B horizon has mollic color. Texture is clay loam or clay. Structure is subangular or angular blocky and soil pH is neutral to slightly acid.

The Csim horizon is platy or massive and strongly cemented or indurated and may have opal coated laminar plates cemented in a mosaic.

The Ruckles family consists of shallow, well drained soils which formed from basalt and tuff. Permeability is slow. These soils are on volcanic plateaus and mountain sideslopes of 5 to 70 percent slope. They occur at elevations of 4400 to 6400 feet. The annual precipitation is 14 to 20 inches which mostly falls during winter as snow. The mean annual air temperature ranges from 44 to 48°F. The frost free season is 80 to 110.

Taxonomic Class: Clayey-skeletal, montmorillonitic, mesic, Lithic Argixerolls.

Reference Pedon: Ruckles family very cobbly loam on a 35 percent east facing mountain sideslope at 5080 feet elevation under big sagebrush, rabbitbrush, sandberg bluegrass and cheatgrass rangeleand. Soil was dry throughout when described on 8/21/79. (Colors are for dry soil unless otherwise noted.)

A1–0 to 4 inches; brown (10YR 5/3) very cobbly loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure which parts into moderate very fine and fine granular; soft, very friable, slighlty sticky and non plastic, 50 percent basalt cobbles and gravel by volume; many very fine and fine, few medium roots; many very fine and fine pores; neutral (pH 7.0); clear smooth boundary.

B21t–4 to 10 inches; dark grayish brown (10YR 4/2) very gravelly clay, very dark grayish brown (10YR 3/2) moist; moderate fine and medium subangular blocky structure; hard, friable, sticky and plastic; common thin clay films on ped faces; 30 percent basalt gravel and 10 percent cobbles by volume; many very fine and fine, few medium roots; many very fine and fine pores; neutral (pH 7.0); cleary wavy boundary.

B22t–10 to 14 inches; brown (7.5YR 5/2) very gravelly clay, dark brown (7.5YR 4/2) moist; moderate to strong medium angular and subangular blocky structure; very hard, firm, sticky and plastic; many moderately thick clay films on ped faces; 40 percent basalt gravel and 15 percent cobbles by volume; common very fine and fine, few medium roots; common very fine and fine pores, neutral (pH 7.2); abrupt smooth boundary.

R–14 plus inches; hard fractured basalt bedrock.

Reference Pedon Location: Modoc County, California, about 40 feet upslope from road and about 900 feet east and 800 feet south of the NW corner of Section 11, T.39N., R.14E.

Range in Characteristics: Depth to a lithic contact of basalt or volcanic tuff is 10 to 20 inches. Clay content in the control section averages 35 to 60 percent and coarse fragments occupy 35 to 70 percent by volume. The mean annual soil temperature at the lithic contact is about 47 to 52°F. and fluctuates by more then 9°F. during the year. The soil temperature at the lithic contact exceeds 41°F. from April 1 through December 1. Where this soil is mapped with map unit 244 the 5 to 15 inch soil moisture control section, or to the lithic contact if shallower, is usually dry in all parts from June 15 through November 15, and moist in all parts from December 15 through May 1. Where this soil is mapped in other map units the moisture control section is usually dry in all parts from July 1 through October 30, and moist in all parts from December 1 through May 1.

The A horizon is 3 to 7 inches thick with dry color of 10YR 4/2, 4/3, 5/2, 5/3, 5/4 or 7.5YR 4/2, 5/2, 5/4, and moist color of 10YR 3/2, 3/3,; 7.5YR 3/2. Texture is loam or clay loam and contains from 25 to 60 percent by volume rock fragments perdominately of the gravel and cobble size with some larger stones. Structure is granular or subangular blocky and soil pH is slightly acid to neutral.

The B horizon makes up the remainder of the soil with dry color of 10YR 4/2, 4/3, 5/2, 5/3, 5/4, 6/2, 6/3; 7.5YR 4/2, 5/2, 5/4; 5YR 3/4, 4/2 or 4/3 and moist color of 10YR 3/2, 3/3, 3/4, 4/2, 4/3; 7.5YR 3/2, 3/4, 4/2, 4/4; 5YR 3/2, 3/3 or 3/4. Mollic color makes up at least the upper 7 inches of the soil and can include the whole soil depth. Texture is clay loam or clay and contains 35 to 70 percent rock fragments by volume. Structure is subangular or angular blocky and soil pH is slightly acid to neutral.

The Sadie family consists of deep, well drained soils formed in geologically recent ash, cinders and pumice which lies on an older basalt capped plateau. Permeability is moderately rapid. The soils are on 1 to 20 percent slopes at 4350 to 5500 feet elevation. Annual precipitation ranges from 20 to 30 inches and mostly falls during the winter as snow. Mean annual air temperature is 45 to 48°F. and the frost free season is 90 to 110 days.

Taxonomic Class: Medial, mesic, Andic Xerochrepts.

Reference Pedon: Sadie family gravelly sandy loam on a 4 percent slope on a southwest aspect at 4650 feet elevation under a ponderosa pine, white fir, incense cedar and sugar pine forest with an understory of bitterbrush, buckbrush and squawcarpet. The soil was dry when described on 7/30/80. (Colors are for dry soil unless otherwise noted).

01–2 to 0 inches; ponderosa pine and white fir needles and twigs.

A1–0 to 5 inches; yellowish brown (10YR 5/4) gravelly sandy loam, dark brown (10YR 3/3) moist; moderate fine and medium granular structure; soft; very friable; nonsticky and nonplastic; 20 percent less than 0.6 inch size cinder gravel by volume; many very fine and fine roots; moderately smeary; neutral (pH 7.0); clear smooth boundary.

B21–5 to 11 inches; yellowish brown (10YR 5/4) gravelly coarse sandy loam, dark yellowish brown (10YR 3/6) moist; weak medium subangular blocky structure; slightly hard, very friable; nonsticky and nonplastic; 20 percent less than 0.6 inch size cinder gravel by volume; common fine, very fine and many medium and coarse roots; few to common fine and medium pores; slightly smeary; slighlty acid (pH 6.4); gradual wavy boundary.

B22-11 to 19 inches; yellowish brown (10YR 5/6) gravelly coarse sandy loam, dark yellowish brown (10YR 3/6) moist; weak to moderate medium subangular blocky structure; slightly hard; very friable; nonsticky and nonplastic; 15 percent less than 0.6 inch size cinder gravel by volume; common fine, very fine, medium and coarse roots; few to commmon fine and medium pores; slightly smeary; slightly acid (pH 6.4) clear wavy boundary.

C–19 to 50 inches; brownish yellow (10YR 6/6) gravelly coarse sandy loam, dark yellowish brown (10YR 4/6) moist; massive; slighlty hard; friable; nonsticky and nonplastic; 15 to 20 percent less than 3/4 inch size cinder gravel by volume; few to common fine, medium and coarse roots; few fine and medium pores; slightly smeary; neutral (pH 6.8); abrupt smooth boundary.

R–50 plus inches; hard fractured vesicular basalt.

Reference Pedon Location: Siskiyou County, California; about 300 feet east of road and 2400 feet south of the NW corner in SW1/4, NW1/4, Section 25, T.42N., R.4E.

Range in Characteristics: Depth to a lithic contact of hard fractured vesicular basalt is greater than 40 inches. The mean annual soil temperature at a depth of 20 inches is about 47 to 52°F. and fluctuates by more than 9°F. during the year. The soil temperature at 20 inches exceeds 41°F. from April 15 through November 30 and exceeds 47°F. from May 1 through November 1 in most years. The soil between depths of 4 to 12 inches is usually moist in all parts from December 1 through May 15 and dry in all parts from July 15 through October 30. The average content of coarse fragments in the control section is 15 to 35 percent by volume. The bulk density of the soil fine earth fraction is estimated to be between 0.8 and 0.95 at 1/3 bar water tension and the ratio of measured clay to 15 bar water is less than 1.25 normally in all parts of the upper 30 inches of soil. The soil has weak to moderate smeary consistency throughout.

The A horizon is 3 to 6 inches thick and has dry color of 10YR 5/3, 5/4, 6/3 or 6/4 and moist color of 10YR 3/3, 3/4, 3/6, 4/3 or 4/4. Texture is sandy loam and contains 15 to 30 percent gravel by volume. It has weak to moderate granular structure. Soil pH is neutral to slightly acid.

The B horizon has dry color of 10YR 5/4, 5/6, 6/4, 6/6 or 7.5YR 5/4, or 5/6 and moist color of 10YR 3/4, 3/6, 4/4, or 7.5YR 3/4, 4/4 or 4/6. Texture is fine sandy loam, sandy loam, or coarse sandy loam and contain 15 to 35 percent gravel by volume. It has weak to moderate subangular blocky structure and soil pH is slightly acid to medium acid.

The C horizon has dry color of 10YR 5/6, 6/4, 6/6, 7/4 and 10YR 4/4, 4/6, 5/4 or 7.5YR 4/4 moist. Texture is sandy loam or coarse sandy loam and contains between 20 to 50 percent by volume gravel. It is massive and soil pH is neutral to medium acid.

The Saprists soils consists of deep, very poorly drained, organic soils that formed from highly decomposed herbaceous materials. Permeability is slow. This soil is on floodplains and drainageways with 0 to 2 percent slope and has an apparent water table which fluctuates to within a few inches of the surface. This soil is very localized in the survey area being mapped only in Jess Valley in the Warner Mountains at an elevation of about 5000 to 5100 feet. Annual precipitation is 14 to 16 inches and the mean annual air temperature is about 48°F. The frost free season is 80 to 100 days.

Taxonomic Class: Mesic, Saprists

Reference Pedon: Saprists soil - all horizons are of sapric materials on a level flood plain at 5040 feet elevation under club moss, milk thistle, sedges, forbes, foxtail barley and other grasses. Soil was moist to saturated below 10 inches when described on 8/27/79. (The colors given are those of the mosit soil.)

0a1–0 to 5 inches; black (10YR 2/1) both rubbed and unrubbed; about 10 to 15% fibers after rubbing; moderate fine and medium platy structure parting to moderate fine and very fine subangular blocky; non-sticky; few to common fine and very fine pores; neutral (pH 6.6); abrupt smooth boundary.

0a2–5 to 10 inches; very dark brown (10YR 2/2), black (10YR 2/1) rubbed; about 5 to 10% fibers after rubbing; moderate to strong fine and medium platy structure; non-sticky; common fine and medium pores; slightly acid (pH 6.4); abrupt smooth boundary.

0a3–10 to 24 inches; dark reddish brown (5YR 3/2) dark reddish brown (5YR 2.5/2) rubbed; about 5 to 10% fibers after rubbing; moderate to strong fine and medium platy structure; slighlty sticky; common to many medium and fine pores; slightly acid (pH 6.2); clear wavy boundary.

0a4–24 to 38 inches; black (10YR 2/1) with 50% less prominent very dark gray (10YR 3/1) mottles; less than 5% fibers when rubbed; moderate fine and medium platy structure; non-sticky; common to many fine and medium pores; slightly acid (pH 6.4); gradual wavy boundary.

0a5–38 to 60 inches; black (10YR 2/1) with 60% less prominent very dark gray (10YR 6/2) mottles; less than 5% fibers after rubbing; weak to moderate medium and coarse platy structure; non-sticky; many medium and common fine pores; neutral (pH 6.8).

Reference Pedon Location: About 70 yards south of elevator ramp on an unaltered site about 300 feet east and 1100 feet north of the SW corner of Section 13, T.39N., R14E.

Range in Charactertistics: This soil is subject to a high fluctuating water table. Most of the area has artifical drainage at present. Capillary action from the lowered water table allows the soil to remain moist to within a few inches of the surface during most of the year. The soil pH is slightly acid to neutral. Mean annual soil temperature is 48° to 50°F. and mean summer and mean winter soil temperature at a depth of 12 inches differs by 9°F or more.

The Oa horizon is greater than 60 inches thick. Soil color is 10YR 3/1, 3/2, 3/3, 4/1, 5/1; 7.5YR 3/4 dry and 10YR 2/1, 2/2, 3/1, 5YR3/2 moist. Mottled or glayed colors begin at 20 to 30 inches in depth and increase in abundance with depth. The soil organic material is sapric, being highly decomposed.

The Searles family consists of moderately deep, well drained soils that formed from basalt. Permeability is moderately slow. These soils are on basalt plateaus with slopes of 1 to 15 percent. Elevation is 4200 to 5000 feet and the annual precipitation is 10 to 14 inches most of which falls during winter as snow. The climate is cool with 46 to 50°F. mean annual air temperature and the frost free season is 90 to 110 days.

Taxonomic Class: Loamy-skeletal, mixed, mesic, Aridic Argixerolls.

Reference Pedon: Searles family gravelly sandy loam on a 10 percent north facing slope at 4600 feet elevation under bitterbrush, big sagebrush, rabbitbrush, desert mahogany and various bunchgrass rangeland. Soil was dry when described on 7/3/80. (Colors are for dry soil unless otherwise stated.)

A11–0 to 4 inches; brown (10YR 5/3) gravelly sandy loam, very dark grayish brown (10YR 3/2) moist; weak to moderate fine granular structure; soft, very friable, slightly sticky and non-plastic; 5 percent cobbles and 15 percent basalt and pumice gravel by volume; many fine and very fine roots; neutral (pH 7.0); clear smooth boundary.

A12–4 to 7 inches; brown (10YR 4/3) gravelly sandy loam, dark brown (7.5YR 3/2) moist; moderate fine granular structure; soft, very friable, slightly sticky and non-plastic; 10 to 15 percent gravel and 5 percent cobbles by volume; many fine, very fine and few medium roots; neutral (pH 7.0); gradual wavy boundary.

B21t–7 to 14 inches; brown (10YR 4/3) cobbly loam, very dark grayish brown (10YR 3/2) moist; weak to moderate fine and medium subangular blocky structure; slighlty hard, friable, sticky and slightly plastic; few thin clay skins on ped faces and pores; 10 percent gravel and 10 percent cobbles by volume; many fine, very fine and common medium roots; common fine and very fine pores; neutral (pH 7.2) clear smooth boundary.

IIB22t–14 to 34 inches; yellowish brown (10YR 5/4) extremely cobbly heavy loam, dark yellowish brown (10YR 3/4) moist; moderate fine subangular blocky structure which parts to moderate medium granular; slightly hard, friable, sticky and plastic; few to common thin clay skins on ped faces and pores; 45 percent cobbles and 30 percent gravel by volume of basalt; common fine, very fine and few medium roots; common fine and very fine pores; neutral (pH 7.2) abrupt smooth boundary.

R–34 plus inches; hard fractured basalt.

Reference Pedon Location: Siskiyou County, California, about 50 feet north of scenic stop by intersection of Lava Beds road and Medicine Lake road and about 450 feet east and 200 feet north of the SW corner of Section 21, T.45N., R.4E.

Range in Characteristics: Depth to basalt bedrock is 20 to 40 inches. The mean annual soil temperature at 20 inches is about 48 to 52°F. and fluctuates by more than 9°F. during the year. The soil temperature at 20 inches exceeds 41°F. from April 1 through December 1 in most years. The 5 to 15 inch soil moisture control section is usually dry in all parts from June 15 through November 15 and moist in all parts from December 15 through May 1. The average clay content in the control section is 22 to 35 percent. A thin pumice overburden of up to 12 inches thick may be present in soil map unit 140.

The A horizon is 5 to 12 inches thick and has dry color of 10YR 4/2, 4/3, 5/2, 5/3, 5/4 and moist color of 10YR 2/2, 3/2, 3/3; 7.5YR 3/2. Texture is loam or sandy loam and normally contain 15 to 50 percent by volume coarse fragments; structure is granular or subangular blocky and soil pH is slightly acid to neutral.

The B horizon normally makes up the rest of the soil and have dry color of 10YR 5/2, 5/3, 5/4, 4/3, 4/4, 6/3, 6/4; 7.5 YR 5/4, 6/4 and moist color of 10YR 3/2. 3/3. 3/4. 4/3. 4/4; 7.5YR 3/2, 3/4, 5/2, or 4/4. The upper parts of the argillic B horizon is mollic in color. Texture is loam and clay loam and contains 35 to 80 percent by volume coarse fragments. Structure is subangular blocky and soil pH is slightly acid to neutral.

SHELD FAMILY

The Sheld family consists of deep, well drained soils formed from volcanic ash and basalt. Permeability is moderate. These soils are on mountain sideslopes of 5 to 30 percent slope and at 5600 to 7000 feet elevation. The climate is cool with 30 to 45 inches annual precipitation which mostly falls as snow in winter. The frost free season is 70 to 100 days and the mean annual air temperature is 38 to 45°F.

Taxonomic Class: Medial-skeletal, frigid, Andic Xerumbrepts.

Reference Pedon: Sheld family gravelly fine sandy loam on a 5 percent west facing lower sideslope at 5800 feet elevation under a white fir and ponderosa pine forest with an understory of snowberry, greenleaf manzanita, Current sp., mint and various grasses. Soil was moist below 12 inches when described on 7/10/80. (Colors are for dry soil unless otherwise stated.)

01–2 to 0 inches: white fir and ponderosa pine needles, twigs and duff.

A11–0 to 5 inches; dark grayish brown (10YR 4/2) gravelly fine sandy loam, black (10YR 2/1) moist; fine granular structure; soft, very friable nonsticky and nonplastic; 15 percent cinder and andesite gravel by volume; many very fine, fine and medium roots; medium acid (pH 5.8); weak to moderately smeary; gradual wavy boundary.

A12–5 to 12 inches; brown (10YR 4/3) gravelly fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium subangular blocky structure which parts into weak fine granular; soft, very friable, nonsticky and nonplastic; 15 percent cinder and andesite gravel by volume; many very fine and fine, common medium and few coarse roots; medium acid (pH 6.0); weak to moderately smeary; clear wavy boundary.

A13–12 to 25 inches; brown (10YR 5/3) very cobbly loam, dark brown (10YR 3/3) moist; weak fine and medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; 20 percent cinder gravel and 25 percent basalt cobbles by volume; common very fine, fine, medium and coarse roots; few fine pores; slightly acid (pH 6.2); weak to moderately smeary; clear wavy boundary.

B2–25 to 44 inches; light yellowish brown (10YR 6/4) very gravelly laom, dark yellowish brown (10YR 3/4) moist; weak medium subangular blocky structure; soft, very friable, slightly stocky and nonplastic; 25 to 30 percent cinder gravel and 10 percent basalt gravel and cobbles by volume; few to common very fine and fine and common medium and coarse roots; few fine tubular pores; slightly acid (pH 6.2) weakly smeary; gradual wavy boundary.

C1–44 to 50 inches; light yellowish brown (2.5YR 6/4) extremely cobbly loam, yellowish brown (10YR 5/4) moist; massive; soft, very friable, slightly sticky and nonplastic; 25 percent cinder gravel and 60 percent basalt cobbles and gravel by volume; few very fine, fine and medium roots; slightly acid (pH 6.2); weakly smeary; abrupt wavy boundary.

R–50 plus inches; hard vesicular basalt.

Reference Pedon Location: Siskiyou County, California, about 100 feet south of road intersection and about 650 feet west and 1800 feet south of the NE corner of Section 1, T.42N., R.3E.

Range in Characteristics: The Sheld family soils are deeper than 40 inches to basalt or unweathered volcanic ash. The mean annual soil temperature at a depth of 20 inches is 40 to 47°F. The 5 to 15 inch soil moisture control section is moist in all parts from about November 15 through May 30. It is dry in all parts from about August 1 through October 20. The soil temperature exceeds 41°F. from May 15 through November 15 and exceeds 47°F. from June 15 through October 15 in most years. The average content of rock fragments in the 10 to 40 inch control section is 35 to 60 percent by volume. The bulk density of the soil fine earth fraction is estimated to be between 0.80 and 0.95 at 1/3 bar water tension and the ratio of measured clay to 15 bar water is less than 1.25 normally in all parts of the upper 30 inches of soil. The estimated base saturation in the A horizon is between 30 and 50 percent by the ammonium acetate method. The soil has weak to moderate smeary consistence throughout.

The A horizon is 10 to 25 inches thick. Soil color is 10YR 4/2, 4/3, 4/4, 5/3, 5/4; 7.5YR 4/4. 4/6; 5YR 4/4 dry and 10YR 2/1, 2/2, 3/2, 3/3; 7.5YR 3/2; 5YR 3/3 moist. Texture is sandy loam or fine sandy loam and normally contains between 15 to 45 percent gravel and cobbles. It has granular or subangular blocky structure and soil pH is medium acid to slightly acid.

The B horizon has dry color of 10YR 5/3, 5/4, 5/6, 6/4; 7.5YR 5/4 and 10YR 4/3, 3/4, 4/4, 4/6; or 5YR 3/4 moist. Texture is loam, sandy loam or fine sandy loam and contain between 35 to 70 percent by volume gravel and cobbles. It has subangular blocky structure and soil pH is slightly acid to medium acid.

The C horizon, if present, has dry color of 10YR 6/4, 6/6, 7/3, 7/4; 2.5YR 6/4 and moist color of 10YR 5/4, 6/3, 6/4; 2.5YR 5/52, 5/4. Texture is loam, sandy loam or loamy coarse sand and contains 40 to 80 percent by volume coarse fragments. Structure is massive and soil pH is slightly acid.

SIMPSON FAMILY

The Simpson family consists of moderately deep, well drained soils that formed in material weathered from basalt and andesite. Permeability is slow. These soils are on basalt plateaus with slopes of 1 to 15 percent. The annual precipitation is 10 to 14 inches, most of which falls during the winter as snow. The mean annual air temperature is 46 to 49°F. and the frost free season is 90 to 110 days.

Taxonomic Class: Fine, montmorillonitic, mesic, Aridic Argixerolls.

Reference Pedon: Simpson family loam on a 5 percent west facing basalt plateau at 4320 foot elevation under rabbitbrush, big sagebrush, Idaho fescue and sandberg bluegrass rangeland. Soil was moist throughout when described on 5/6/80. (Colors are for dry soil unless otherwise stated.)

A1–0 to 3 inches; brown (10YR 5/3) loam; very dark grayish brown (10YR 3/2) moist; weak to moderate fine and very fine platy structure parting to moderate fine and very fine granular; slighlty hard, very friable, sticky and plastic; many fine and very fine roots; common to many fine and very fine tubular pores; 10 to 15 percent by volume basalt cobbles and gravel; neutral (pH 7.2); abrupt, smooth boundary.

B21t–3 to 8 inches; brown (10YR 4/3) silty clay loam, dark brown, (10YR 3/3), moist; moderate medium subangular blocky structure parting to moderate fine and very fine granular; hard, firm, very sticky and plastic; many fine and very fine roots; common very fine tubular pores; few to common thin clay skins on ped faces; less than 5 percent by volume basalt cobbles and gravel; neutral (pH 7.2); clear, smooth boundary.

B22t–8 to 22 inches; brown (7.5YR 5/4) silty clay, brown (7.5YR 4/4) moist; moderate to strong medium prismatic structure parting to strong fine and medium angular blocky; extremely hard, firm, very sticky and very plastic; few to common very fine and fine roots, and few to common very fine tubular pores; common prominent clay skins on ped faces and pores; mildly alkaline (pH 7.4); clear, wavy boundary.

B3t–22 to 28 inches; strong brown (7.5YR 5/6) silty clay, brown (7.5YR 4/4) moist; moderate medium and coarse subangular blocky structure; hard, firm, very sticky and very plastic; few to common fine and very fine roots; many fine, very fine and common medium tubular pores; few to common thin clay skins on ped faces; mildly alkaline (pH 7.6); abrupt, smooth boundary.

IIC1ca–28 to 30 inches; yellowish brown (10YR 5/4), semi-consolidated ashy tuff which rubs to a clay loam, dark yellowish brown (10YR 3/4) moist; massive; very hard, friable, sticky and plastic; few very fine roots, common fine and very fine pores; few distinct medium and coarse calcium carbonate nodules; strongly effervescent; mildly alkaline (pH 7.6); abrupt smooth boundary.

IIIR–30 plus inches; hard vesicular basalt.

Reference Pedon Location: Siskiyou County, California, about 100 feet east of road and about 700 feet west and 600 feet north of the SE corner of Section 15, T.46N., R.3E.

Range in Characteristics: Depth to bedrock is 20 to 40 inches. The mean annual soil temperature at 20 inches is about 48 to 52°F. and fluctuates by more than 9°F. during the year. The soil temperature at 20 inches exceeds 41°F. from April 1 through December 1 in most years. The 4 to 12 inch soil moisture control section is usually dry in all parts from June 15 through November 15 and moist in all parts from December 15 through May 1. The clay content in the control section averages 35 to 60 percent.

The A horizons are 3 to 8 inches thick and have dry color of 10YR 4/2, 4/3, 5/2, 5/3, 5/4 and moist color of 10YR 3/2, 3/3; 7.5YR 3/2. Texture is loam or clay loam and normally contains less than 15 percent coarse fragments; structure is platy or granular and soil pH is neutral to mildly alkaline.

The B horizons normally make up the rest of the soil and have dry color of 10YR 5/2, 5/3, 5/4, 4/3, 4/4, 6/3, 6/4, 6/6; 7.5YR 5/4, 6/4 and moist color of 10YR 3/2, 3/3, 3/4, 4/3, 4/4; 7.5YR 3/2, 3/4, 4/2, 4/4 or 4/6. The upper part of the argillic B horizons are mollic in color. Textures are clay loam, clay silty clay loam or silty clay and normally contain less than 15 percent by volume coarse fragments. Structure is prismatic, subangular or angular blocky and soil pH is neutral to mildly alkaline.

The C horizons, if present, have dry color of 10YR 5/4, 6/3, 6/4 and moist color of 10YR 3/4, 4/3, 4/4, 4/5. Texture is clay loam or clay and contain from 0 to 40 percent by volume coarse fragments. Structure is massive or platy and soil pH is mildly alkaline.

The Skalan family consists of moderately deep and deep, well drained soils that formed from basalt. In this survey area it also has a geologically recent pumice deposit on the surface. Permeability is rapid in the pumice overburden and moderately slow below. These soils are on basalt plateaus with 1 to 10 percent slopes. Elevation is 4200 to 4500 feet and annual precipitation is 16 to 20 inches and mostly falls during the winter as snow. Mean annual air temperature is 48 to 50°F. and the frost free season is 90 to 110 days.

Taxonomic Class: Loamy-skeletal, mixed, mesic, Ultic Haploxeralfs.

Reference Pedon: Skalan family gravelly loamy coarse sand on a gently undulating basalt plateau at 4360 foot elevation under a sparce canopy of ponderosa pine with bitterbrush, big sagebrush and bunchgrass understory. Soil was dry throughout when described on 8/14/78. (Colors are for dry soil unless otherwise stated.)

01–1/2 to 0 inches; ponderosa pine and brush needles, leaves and twigs.

A1–0 to 4 inches; grayish brown (10YR 5/2) gravelly loamy coarse sand, very dark grayish brown (10YR 3/2) moist; single grained; loose, non-sticky and non-plastic; 30 percent by volume pumice gravel mainly of the less than 0.6 inch size; many fine, very fine and few medium roots; slightly acid (pH 6.2) clear smooth boundary.

C1–4 to 8 inches; very pale brown (10YR 8/3) extremely gravelly sand, very pale brown (10YR 7/3) moist; single grained; loose, non-sticky and non-plastic; 85 percent pumice gravel by volume mainly of the 0.2 to 1.0 inch size; common very fine, fine and medium roots; slightly acid (pH 6.4); clear smooth boundary.

IIA1b–8 to 20 inches; light yellowish brown (10YR 6/4) extremely cobbly loam, dark brown (7.5YR 3/4) moist; weak fine and medium subangular blocky structure which parts to moderate fine granular; slightly hard, friable, slightly sticky and slightly plastic; 35 percent cobbles, 15 percent stones and 20 percent gravel by volume of basalt; common fine, very fine and few medium and coarse roots; common fine and medium pores; slightly acid (pH 6.4); gradual wavy boundary.

IIB2tb–20 to 32 inches; light yellowish brown (10YR 6/4) extremely stony clay loam, dark yellowish brown (10YR 3/4) moist; moderate fine subangular blocky structure; hard, friable, sticky and plastic; few to common thin clay films on ped faces; 35 percent stones; 20 percent cobbles and 15 percent gravel by volume of basalt; common very fine and fine and few to common medium and coarse roots; many fine, very fine and few medium pores; neutral (pH 6.6) abrupt wavy boundary.

R–32 plus inches; hard fractured basalt.

Reference Pedon Location: Modoc County, California, about 700 feet west and 1500 feet north of the SE corner of Section 23, T.44N., R.5E.

Range in Characteristics: Depth to a lithic contact is greater then 30 inches. The control section averages 24 to 35 percent clay content and also averages 35 to 80 percent by volume rock fragments. Base saturation is estimated to be 60 to 75 percent, by sum of cations, in at least the upper parts of the argillic horizons. The mean annual soil temperature at 20 inches is about 50 to 53°F. and fluctuates by more than 9°F. during the year. The soil temperature at 20 inches exceeds 41°F. from April 15 through November 30 and exceeds 47°F. from May 1 through November 1 in most years. The soil in the moisture control section is usually moist in all parts from December 1 through May 15 and dry in all parts from July 15 through October 30.

The Skalan family soils in this survey have an approximate 900 year old pumice deposit from 8 to 20 inches thick. This pumice deposit is always less than half the thickness of the combined A and B horizons of the underlying soil. The pumice overburden consists of an A-C horizon development. The pumice A horizon is 2 to 5 inches thick and has dry color of 10YR 5/1, 5/2, 5/3, 6/2, 6/3 and moist color of 10YR 3/2, 3/3, 3/4, 4/2, 4/3. Texture is coarse loamy sand or coarse sand and contains 25 to 45 percent gravel mainly of the less than 0.6 inch size. It is single grained and soil pH is neutral to slightly acid. The pumice overburden C horizon, has dry color of 10YR 7/3, 7/4, 8/3 and moist color of 10YR 6/3 or 7/3. Texture is coarse sand and contains 65 to 90 percent by volume gravel mainly of the 0.2 to 1.0 inch size. It is single grained and soil pH is neutral to slightly acid.

The soil underlying the pumice overburden has an A-B horizon development.

The A horizons are 6 to 12 inches thick and have dry color of 10YR 5/4, 6/3, 6/4; 7.5YR 4/4, 5/4 and moist color of 10YR 3/4, 4/4; 7.5YR 3/4, 4/4. Texture is loam and contains 35 to 70 percent by volume weathered cinder gravels and basalt gravel, cobbles and stones. Structure is granular or subangular blocky and soil pH is neutral to slightly acid.

The B horizons have dry color of 10YR 5/4, 6/4, 6/6; 7.5YR 5/4, 5/6. 6/4 and moist colors of 10YR 3/4, 3/6, 4/4, 4/6; 7.5YR 3/4, 4/4, 4/6. Texture is clay loam or loam and contains from 35 to 80 percent by volume rock fragments. Structure is subangular blocky and soil pH is neutral to slightly acid.

The Smarts family consists of moderately deep and deep, well drained soils that formed from basalt or tuff. Permeability is moderately slow. These soils are on mountain sideslopes of 2 to 60 percent slope. Elevation ranges from 5300 to 7500 feet. The annual precipitation is 20 to 30 inches most of which falls during the winter as snow. Mean annual air temperature is 40 to 46°F. The frost free season is 60 to 90 days.

Taxonomic Class: Loamy-skeletal, mixed, frigid, Pachic Ultic Argixerolls.

Reference Pedon: Smarts family stony loam on a 47 percent northeast facing sideslope at 5800 foot elevation under a ponderosa pine and white fir forest with an understory of current sp., rabbitbrush, mulesear and grasses. Soil was dry throughout when described on 8/29/79. (Colors are for dry soils unless otherwise noted.)

01–1/2 to 0 inches; Ponderosa pine and white fir needles and twigs.

A11–0 to 14 inches; reddish brown (5YR 4/3) stony loam, dark reddish brown (5YR 2.5/2) moist; moderate fine and medium granular structure; slightly hard, very friable, slightly sticky and slightly plastic; 30 to 35 percent basalt rock fragments by volume consisting of 20 percent stones and cobbles and 10 to 15 percent gravel; many very fine and fine and common medium roots; neutral (pH 6.6); clear wavy boundary.

A12–14 to 20 inches; reddish brown (5YR 4/3) very cobbly loam, dark reddish brown (5YR 3/2) moist; weak medium and coarse subangular blocky structure; hard, friable, sticky and slightly plastic; 45 percent basalt rock fragments by volume consisting of 25 percent gravel and 20 percent cobbles and stones; many very fine, fine and medium and common coarse roots; many very fine and fine and few medium pores; neutral (pH 6.8); clear wavy boundary.

B21t–20 to 28 inches; reddish brown (5YR 5/3) very gravelly loam, dark reddish brown (5YR 3/2) moist; moderate fine and medium subangular blocky structure; hard, friable, sticky and slightly plastic; common thin clay films on ped faces; 50 percent highly weathered basalt gravel and cobbles by volume; many very fine and fine and common medium and coarse roots; many very fine and fine and few medium pores; neutral (pH 6.8); clear wavy boundary.

B22t–28 to 35 inches; brown (7.5YR 5/4) extremely gravelly clay loam, dark brown (7.5YR 3/4) moist; strong fine and medium subangular blocky structure; very hard, friable, sticky and plastic; common thin clay films on ped faces 80 percent highly weathered basalt gravel and few cobbles by volume; common very fine and fine and few medium and coarse roots; few very fine and fine pores; neutral (pH 6.8); gradual wavy boundary.

Cr–35 plus inches; gray (5YR 6/1) highly weathered soft vesicular basalt which can be cut with a shovel.

Reference Pedon Location: Lassen County, California, about 30 feet upslope of road going to Mahogany Ridge and about 1250 feet west and 2050 feet south of the NE corner of Section 32, T.39N., R.15E.

Range in Characteristics: Depth to bedrock is greater than 40 inches in soil map units 129, 148, 149, 194, 195, 196, 254, 255 and 256; both 20 to 40 inches and greater than 40 inches in units 252, 253; and 20 to 40 inches in the other units it is mapped in. The control section averages 24 to 35% clay content and rock fragments average from 35 to 75% by volume. Base saturation by the ammonium acetate method is estimated to be between 50 to 75 percent normally throughout the upper 30 inches of the soil. The mean annual soil temperature at a depth of 20 inches is 41 to 47°F. and fluctuates by more than 9°F. during the year. The soil temperature at the 20 inch depth exceeds 41°F. from June 15 through October 15 in most years. The 5 to 15 inch soil moisture control section is usually moist in all parts from November 15 through May 30 and dry in all parts from August 1 through October 20.

The A horizons are 10 to 24 inches thick with dry color of 7.5YR 4/2, 4/3, 4/4; 5YR 4/2, 4/3, 4/4; 10YR 4/3 or 4/4 and moist color of 7.5YR 3/2; 5YR 2.5/2, 3/2, 3/3; 10YR 3/2 or 3/3. Texture is loam and normally contains from 15 to 50 percent by volume cobbles, stones and gravel. Structure is granular or subangular blocky and soil pH is medium acid to neutral.

The B horizons make up the remaining soil and have dry color of 10YR 4/2, 4/3, 4/4, 5/3, 5/4; 7.5YR 4/2, 4/4, 5/4; 5YR 4/3, 4/4, 5/3, 5/4 and moist collor of

10YR 3/2, 3/3, 3/4; 7.5YR 3/2, 3/4, 4/4; 5YR 3/2, 3/3, 3/4, 4/3 or 4/4. The upper parts of the argillic B horizons have mollic colors and may include the whole soil profile. Texture is loam or clay loam and contains from 35 to 85 percent by volume rock fragments which increase in amount with depth. Structure is subangular blocky and soil pH is medium acid to neutral.

STONEWELL FAMILY

The Stonewell family consists of moderately deep and deep, somewhat excessively drained soils formed from volcanic ash, cinders, pumice, andesite and basalt. Permeability is rapid in the pumice overburden if present, and moderately rapid below. These soils are on 2 to 70 percent slopes and occur on volcanic mountain uplands, and sideslopes of cinder cones. They are often covered by a thick deposit of recent pyroclastic pumice. Elevation ranges from 4600 to 6900 feet. Annual precipitation is 25 to 40 inches, most of which falls during the winter as snow. Mean annual air temperature is 40 to 46°F. The frost free season is 70 to 90 days.

Taxonomic Class: Cindery, frigid, Dystric Xerorthents.

Reference Pedon: Stonewell family gravelly sandy loam on a nearly level lower sideslope at 5580 feet elevation under a mixed ponderosa pine and white fir forest with a greenleaf manzanita understory. Soil was moist throughout when described on 5/22/80. (Colors are for dry soils unless otherwise stated.)

01–1 to 0 inches; white fir and ponderosa pine needles and twigs.

A1–0 to 4 inches; dark grayish brown (10YR 4/2) gravelly sandy loam, very dark brown (10YR 2/2) moist; weak to moderate fine and medium granular structure; soft, very friable, non-sticky and non-plastic; 20 to 25 percent by volume weathered cinders and pumice gravel; many very fine and fine and common medium roots; slightly acid (pH 6.4); clear smooth boundary.

C1–4 to 12 inches; brown (7.5YR 5/4) very gravelly sandy loam, dark brown (7.5YR 3/4) moist; weak to moderate fine and medium granular structure; soft, very friable, non-sticky and non-plastic; 45 percent by volume weathered pumice and cinder gravel; common to many very fine and fine and common medium and coarse roots; slightly acid (pH 6.4); gradual wavy boundary.

C2–12 to 24 inches; yellowish brown (10YR 5/6) very gravelly sandy loam, brown (7.5YR 4/4) moist; weak fine and medium granular structure; soft, very friable, non-sticky and non-plastic; 45 percent by volume weathered pumice and cindery gravel; common to many very fine and fine and common medium and coarse roots; slightly acid (pH 6.4); abrupt smooth boundary.

IIC3–24 to 31 inches; strong brown (7.5YR 5/6) extremely gravelly loamy sand, yellowish red (5YR 4/6) moist; single grained; loose, non-sticky and non-plastic; 90 percent by volume cinder gravel; few very fine, fine, medium and coarse roots; neutral (pH 6.6); abrupt smooth boundary.

IIC4–31 to 42 inches; yellowish red (5YR 5/6) extremely gravelly coarse sand, yellowish red (5YR 4/6) moist; single grained; loose, non-sticky and non-plastic; 85 percent by volume cinder gravel; few very fine, fine, medium, and coarse roots; slightly acid (pH 6.5); abrupt smooth boundary.

IIIC5–42 to 51 inches; light yellowish brown (10YR 6/4) 1 to 3 inch thick stratified lenses of very fine sandy loam, silt loam and very gravelly coarse sand, dark yellowish brown (10YR 4/4) moist; soft, very friable, non-sticky and non-plastic; 50 percent by volume cinder gravel; common very fine and fine and few to common medium roots; medium acid (pH 6.0); abrupt smooth boundary.

IVC6–51 to 60 inches; brown (7.5YR 5/4) extremely gravelly coarse sand, dark reddish brown (5YR 3/4) moist; single grained; loose, non-sticky and non-plastic; 90 percent cinder gravel by volume; few very fine and fine roots; neutral (pH 6.0).

Reference Pedon Location: Siskiyou County, California, about 100 feet northwest of road intersection and about 2300 feet east and 1100 feet north of the SW corner of Section 33, T.43N., R.7E.

Range in Characteristics: Depth to a contact of basalt, andesite or unweathered cinders is greater than 30 inches. The mean annual soil temperature at a depth of 20 inches is about 41 to 47°F. and fluctuates by more than 9°F. during the year. The soil temperature at 20 inches exceeds 41°F. from May 15 through November 15 and exceeds 47°F. from June 15 through October 15 in most years. The soil in the moisture control section is usually moist in all parts from November 15 through May 30 and dry in all parts from August 1 through October 20. The control section averages 35 to 95 percent mainly less than 1 inch gravel size pumice and/or weathered cinders by volume. The bulk density of the soil fine earth fraction is estimated to be less than

0.95 at 1/3 bar water tension and the ratio of measured clay to 15 bar water is less than 1.25 in all parts of the soil. It is estimated that more than 60 percent of the whole soil by weight is volcanic ash, cinders and/or pumice throughout the soil. It is estimated that these soils have less than 60 percent base saturation by the ammonium acetate method normally throughout the whole soil depth.

There are three Stonewell family soil phases recognized in this survey. They consist of Stonewell family pumice phase; Stonewell family pumice overburden phase; and Stonewell family without pumice.

The Stonewell family, pumice phase consists of a geologically recent pumice deposition of 35 to greater than 60 inches in depth. This pumice material may be over a loamy textured cindery material, or is directly over basalt flow rock. The A horizon is 1 to 6 inches thick and ranges in color from 10YR 5/4, 5/3, 5/2 or 4/2 dry, and 10YR 3/4, 3/3, 3/2 or 2/2 moist. Texture is loamy sand or sand with 35 to 60 percent pumice gravel. The C horizon has colors of 10YR 8/3, 7/2, 6/3 or 6/2 dry, and 10YR 7/3, 6/3, 6/2, 5/3, 5/2, 4/3 moist. Texture in the pumice C material is coarse sand and contains from 70 to 95 percent pumice gravel mainly of the less than 3/4 inch size.

The Stonewell family, pumice overburden phase where mapped consists of geologically recent pumice deposition 6 to 20 inches in depth over a loamier textured cindery material below this pumice overburden. The pumice overburden consists of an A horizion 2 to 6 inches in depth and is gravelly coarse loamy sand with 15 to 35 percent gravel mainly of the less than 0.6 inch size. Colors are 10YR 5/4, 5/3, 5/2 dry and 10YR 4/3, 4/2, 3/3 or 3/2 moist. The pumice C horizon is coarse sand with 60 to 90 percent gravel mainly of the 0.2 to 1.0 inch size. Colors are 10YR 8/3, 7/3 or 7/2 dry and 10YR 7/3 or 6/3 moist. The burried IIAb horizon below the pumice mantle is 4 to 14 inches thick and are fine sandy loam or sandy loam in texture with 10 to 50 percent weathered cinder gravel mainly of the less than 0.6 inch size. Colors are 10YR 6/4 or 5/4 dry, 10YR 4/4 or 3/4 moist. The C horizon is sandy loam, loamy sand or sand. Gravel content ranges from 40 to 85 percent and are mainly less than 3/4 inch in size and consist of older weathered pumice and cinder material. Colors are 10YR 7/4, 6/6, 6/4, 6/3 dry and 10YR 6/6, 4/6, 4/4 moist.

The Stonewell family without the recent pumice deposition has an A horizon 2 to 9 inches in depth. Textures range from sandy loam to fine sandy loam. Gravel content is 20 to 50 percent by volume and mainly of the less than 0.4 inch size. Colors are 10YR 5/4, 5/3, 4/2, 4/2 dry and 10YR 3/4, 3/3, 3/2 or 2/2 moist. The C horizon has textures of sandy loam, or coarse sandy loam and grades to loamy coarse sand or coarse sand with depth. Gravel content is 40 to 90 percent by volume and mainly of the less than 1 inch size. The gravel consists of older weathering cinders and pumice. Dry colors are 10YR 5/4, 5/6, 6/4, 6/6; 7.5YR 5/4, 5/6, 6/4, 6/6; 5YR 5/4, 5/6, 6/4, 6/6 and moist colors are 5YR 3/4, 4/4, 4/6; 7.5YR 3/4, 4/4, 4/6; 10YR 4/4, 4/6, 5/6.

STUKEL FAMILY

The Stukel family consists of shallow, well drained soils formed in material weathered from basalt. Permeability is moderate. These soils are on 1 to 10 percent slopes and occur on basalt plateaus at 4200 to 5200 feet elevation. The annual precipitation is 10 to 16 inches which mostly falls during the winter as snow. The mean annual air temperature is 45 to 50°F. The frost free season is 90 to 110 days.

Taxonomic Class: Loamy, mixed, mesic, Lithic Haploxerolls.

Reference Pedon: Stukel family very cobbly loam on a nearly level basalt plateau of 4360 feet elevation under rabbitbrush, big sagebrush, bitterbrush, Idaho fescue, sandberg bluegrass and wheatgrass rangeland. Soil was moist throughout when described on 5/6/80. (Colors are for dry soil unless otherwise noted.)

A11–0 to 3 inches; grayish brown (10YR 5/2) very cobbly loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium platy structure which parts to moderate fine and medium granular; soft, very friable, slightly sticky and nonplastic; 15 percent gravel and 30 percent cobbles by volume; many very fine and fine and few medium roots; many very fine and fine pores; slightly acid (pH 6.2); abrupt smooth boundary.

A12–3 to 6 inches; brown (10YR 5/3) loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium platy structure and which parts to moderate fine and medium granular; soft very friable, slightly sticky and slightly plastic; 10 to 15 percent gravel and cobbles by volume; many very fine and fine, and few medium roots; many very fine and fine pores; neutral (pH 6.8); clear wavy boundary.

A13–6 to 11 inches; brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; weak to moderate fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; 10 percent gravel and cobbles by volume; common very fine and fine, and few medium roots; common fine pores; neutral (pH 7.2); abrupt wavy boundary.

R–11 plus inches; hard vesicular basalt.

Reference Pedon Location: Siskiyou County, California, about 1250 feet east and 1400 feet south of the NW corner of Section 35, T.46N., R.3E.

Range in Characteristics: Depth to the lithic contact ranges from 8 to 20 inches. The mean annual soil temperature at the lithic contact is about 47 to 53°F. and fluctuates by more than 9°F. during the year. The soil temperature at the lithic contact exceeds 41°F. from April 1 through December 1. Where this soil is mapped in map units 122 and 266 the soil between depths of about 4 to 12 inches, or lithic contact if shallower, is usually dry in all parts from June 15 through November 15, and moist in all parts from December 15 through May 1. Where this soil is mapped with map unit 267 the soil at the 4 to 12 inch depth, or lithic contact if shallower, is usually dry in all parts from July 1 through October 30, and moist in all parts from December 1 through May 1. The coarse fragment content of the control section averages 5 to 35 percent by volume and clay content averages 16 to 24 percent.

The A horizon normally makes up the whole soil depth with dry color of 10YR 4/2, 4/3, 5/2, 5/3, 5/4,; 7/5YR 4/2, 4/4, 5/4 and moist color of 10YR 2/2, 3/2, 3/3; 7.5YR 3/2. Texture is loam or sandy loam and contains from 0 to 40 percent surface rock fragments. Structure is granular or subangular blocky and soil pH is neutral to slightly acid.

SUPAN FAMILY

The Supan family consists of moderately deep and deep, well drained soils formed from basalt. Permeability is moderately slow. The soils are on basalt plateaus and mid to lower sideslopes of mountain uplands and are on 1 to 20 percent slopes. They occur at elevations of 4300 to 6000 feet. The annual precipitation is 14 to 16 inches which mostly falls during the winter as snow. Mean annual air temperature is 44 to 49°F. The frost free seaon is 80 to 110 days.

Taxonomic Class: Fine-loamy, mixed, mesic, Pachic Argixerolls.

Reference Pedon: Supan family loam on a 5 percent north facing sideslope at 5200 feet elevation under western juniper and mountain mahogany with an understory of big sagebrush, chickweed, arrowleaf balsomroot, Sandberg bluegrass and cheatgrass. Soil was moist throughout when described on 4/16/80. (Colors are for dry soil unless otherwise stated.)

A11–0 to 15 inches; brown (10YR 4/3) loam, dark brown (7.5YR 3/2) moist; weak medium and coarse subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; 5 percent gravel by volume; many very fine, fine, common medium and coarse roots; neutral (pH 6.8); gradual smooth boundary.

A12–15 to 23 inches; brown (10YR 4/3) loam, dark brown (7.5YR 3/2) moist; moderate medium and coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; 5 percent gravel by volume; many very fine, fine, common medium and coarse roots; neutral (pH 6.8); gradual smooth boundary.

B21t–23 to 34 inches; dark yellowish brown (10YR 4/4) gravelly clay loam, dark brown (7.5YR 3/2) moist; moderate medium and coarse subangular blocky structure; hard, friable, sticky and plastic; common moderately thick clay films on ped faces; 15 percent gravel and 10 percent cobbles by volume; common very fine and fine and few medium and coarse roots; many very fine and few fine pores; neutral (pH 6.8); clear wavy boundary.

B22t–34 to 44 inches; brown (10YR 4/3) gravelly clay loam, dark brown (7.5YR 3/2) moist; moderate medium subangular blocky structure; hard, friable, sticky and plastic; common moderately thick clay films on ped faces and pores; 20 percent gravel and 10 percent cobbles by volume; common moderately thick clay films on ped faces and pores; 20 percent gravel and 10 percent cobbles by volume; common very fine and fine, few medium and coarse roots; common fine pores; neutral (pH 6.8); clear wavy boundary.

B23t–44 to 59 inches; dark grayish brown (10YR 4/2) very gravelly clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure; hard, friable, sticky and plastic; common moderately thick clay films on ped faces and pores; 30 percent gravel and 10 percent cobbles by volume; common very fine and fine, few medium and coarse roots; common fine pores; neutral (pH 6.8); clear wavy boundary.

B24t–59 to 69 inches; dark grayish brown (10YR 4/2) extremely cobbly clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine and medium subangular blocky structure; hard, friable, sticky and plastic; few to common thin clay films on ped faces and pores; 30 percent gravel and 35 percent cobbles by volume; common very fine and fine, few medium roots; common very fine and fine pores; neutral (ph 6.8); clear wavy boundary.

Cr–69 to 72 inches; moderately weathered soft vesicular basalt which can be cut with a shovel.

Reference Pedon Location: Modoc County, California, about 30 feet east of road and about 700 feet east and 50 feet north of the SW corner of Section 18, T.45N., R.11E.

Range in Characteristics: Depth to bedrock is 20 to 40 inches in some pedons and greater than 40 inches in others. The control section averages 25 to 35 percent clay content and also averages 10 to 35 percent by volume coarse fragments. The mean annual soil temperature at a depth of 20 inches is 47 to 52°F. and fluctuates by more than 9°F. during the year. The soil temperature at the 20 inch depth exceeds 41°F. from April 15 through November 15 in most years. The 4 to 12 inch soil moisture control section is usually moist in all parts from December 1 through May 1 and dry in all parts from July 1 through October 30.

The A horizon is 11 to 23 inches thick with dry color of 10YR 4/2, 4/3, 5/2, 5/3; 7.5YR 4/2,/4/4 and moist

color of 10YR 2/2, 3/2, 3/3; 7.5YR 3/2; 5YR 3/2, 3/3. Texture is loam and normally contains less than 15 percent by volume coarse fragments. Structure is granular or subangular blocky and soil pH is slightly acid to neutral.

The B horizon normally occupies the remainder of the soil and have dry color of 10YR 4/2, 4/3, 4/4, 5/3, 5/4; 7.5YR 4/2, 4/4, 5/4; 5YR 4/3, 4/4, 5/3, 5/4 and moist color of 10YR 3/2, 3/3, 3/4; 7.5YR 3/2, 3/4, 4/4; 5YR 3/3, 4/3, 4/4. The upper parts of the argillic B horizon has mollic color and may include the whole soil depth. Texture is clay loam or loam and contains from 10 to 65 percent by volume coarse fragments which become greater in percent with depth. Structure is prismatic or subangular blocky, and soil pH is slightly acid to neutral.

SUPERVISOR FAMILY

The Supervisor family consists of moderately deep, well drained soils that formed in andesite or tuff. Permeability is moderate. These soils are on 10 to 80 percent slopes and occur on toeslopes and sideslopes of mountain uplands at 7000 to 9800 feet elevation. The climate is cold with 34 to 40°F mean annual air temperature and 25 to 35 inches annual precipitation which falls mostly as snow during the winter. The frost free season is less than 30 days to 70 days.

Taxonomic Class: Loamy-skeletal, mixed, Typic Cryoborolls.

Reference Pedon: Supervisor family gravelly fine sandy loam on a 40 percent east facing mountain sideslope at 7660 feet elevation under lodgepole pine and western white pine forest with a sparse understory of prostrate manzanita and few grasses. Soil was dry below 5 inches when described on 9/17/80. (Colors are for dry soil unless otherwise stated.)

01–1 to 0 inches; lodgepole pine needles and twigs.

A11–0 to 5 inches; dark grayish brown (10YR 4/2) gravelly fine sandy loam, black (10YR 2/1) moist; weak to moderate fine granular structure; slightly hard, very friable, nonsticky and nonplastic; 20 percent gravel by volume; common very fine, fine and medium roots; slightly acid (pH 6.2); clear smooth boundary.

A12–5 to 12 inches; brown (10YR 5/3) gravelly fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure which parts into weak to moderate fine granular; slightly hard, very friable, nonsticky and nonplastic; 30 percent gravel by volume; common very fine, fine, medium and coarse roots; medium acid (pH 6.0); gradual wavy boundary.

B21–12 to 18 inches; yellowish brown (10YR 5/4) very gravelly sandy loam, dark yellowish brown (10YR 3/4) moist; weak fine subangular blocky structure; slightly hard, very friable; nonsticky and nonplastic; 35 to 40 percent gravel by volume; common very fine, fine and medium and few coarse roots; few to common very fine, fine and medium pores; medium acid (pH 5.8); gradual wavy boundary.

B22–18 to 26 inches; yellowish brown (10YR 5/4) very gravelly sandy loam; dark yellowish brown (10YR 3/4) moist; weak to moderate fine and medium subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; 55 to 60 percent gravel by volume; common very fine, fine and medium and few coarse roots; few to common very fine and fine pores; medium acid (pH 5.8); clear smooth boundary.

Cr–26 to 37 inches; very pale brown (10YR 7/3) and strong brown (7.5YR 4/6) weathered in place tuff conglomerate which can be dug with a spade.

R–37 plus inches; slightly weathered andesite and conglomerated tuff.

Reference Pedon Location: Modoc County, California, about 40 feet upslope from road and about 700 feet east and 100 feet south of the NW corner of Section 4, T.44N., R.15E.

Range in Characteristics: Depth to a lithic or paralithic contact ranges from 20 to 40 inches. The mean annual soil temperature at the 20 inch depth is about 36 to 42°F. The soil temperature at the 20 inch depth exceeds 41°F. from July 1 through October 30 and exceeds 47°F. from July 20 through September 20 in most years. The mean summer soil temperature at 20 inches is less than 47°F. The 5 to 15 inch soil moisture control section is usually moist in all parts from November 1 through June 15 and dry in all parts from August 15 through October 10. The coarse fragment content of the control section averages 35 to 70 percent by volume and the clay content averages 12 to 18 percent.

The A horizon is 8 to 16 inches in depth and have dry color of 10YR 4/2, 4/3, 5/3 or 5/4 and moist color of 10YR 2/1, 2/2, 3/2 or 3/3. Texture is fine sandy loam or sandy loam with 15 to 50 percent by volume coarse fragments consisting mainly of gravel size with lesser amounts of cobbles. Structure is granular or subangular blocky and soil pH is medium acid to slightly acid.

The B horizon normally occupies the remainder of the soil with dry color of 10YR 5/4, 5/6, 6/3, 6/4; 7.5YR 5/4, 5/6 and moist color of 10YR 3/4, 4/3, 4/4, 4/6; 7.5YR 3/4, 4/4 or 4/6. Texture is sandy loam or fine sandy loam and contains from 35 to 75 percent by volume coarse fragments predominately of gravel size. Structure is subangular blocky and soil pH is medium acid to slightly acid.

VIPONT FAMILY

The Vipont family consists of moderately deep, well drained soils that formed from andesite and basalt. permeability is moderately slow. These soils are on 15 to 35 percent slopes and occur on mid to lower sideslopes, toeslopes and drainageways of mountain uplands at 5500 to 7000 feet elevation. The climate is cool with 40 to 46°F mean annual air temperature and 20 to 22 inches annual precipitation which mostly falls as snow during the winter. The frost free season is 60 to 90 days.

Taxonomic Class: Loamy-skeletal, mixed, frigid, Pachic Argixerolls.

Reference Pedon: Vipont family very gravelly loam on a 20 percent east facing mountain sideslope at 6300 feet elevation under mountain mahogany, big sagebrush, squawcarpet, greenleaf manzanita, mule ears and various bunchgrasses and a few encroaching white fir and ponderosa pine. Soil was dry below 9 inches when described on 11/4/81. (Colors are for dry soil unless otherwise noted.)

A11-0 to 9 inches; brown (7.5YR 4/2) very gravelly loam, dark brown (7.5YR 3/2) moist; moderate fine and medium granular structure; slightly hard, very friable, slightly sticky and slightly plastic; 35 percent gravel by volume; many very fine, fine and medium and common coarse roots; neutral (pH 6.8); gradual wavy boundary.

A12-9 to 16 inches; brown (7.5YR 4/2) very gravelly loam, dark brown (7.5YR 3/2) moist; weak fine subangular blocky structure which parts into weak to moderate granular structure; slightly hard, very friable, slightly sticky and slightly plastic; 30 percent gravel and 10 percent cobbles by volume; many very fine and fine and common medium and coarse roots; common to many very fine and fine and common medium and coarse pores; neutral (pH 6.8); clear smooth boundary.

B21t–16 to 21 inches; brown (7.5YR 4/4) very gravelly clay loam, dark brown (7.5YR 3/2) moist; moderate fine subangular blocky stucture; slightly hard, friable, sticky and plastic; few thin clay films on ped faces and pores; 10 percent cobbles and 45 percent gravel by volume; common very fine and fine and few coarse roots; common very fine and fine and few coarse pores; neutral (pH 6.8); clear wavy boundary.

B22t–21 to 27 inches; brown (7.5YR 5/4) very cobbly clay loam, dark brown (7.5YR 3/4) moist; moderate fine subangular blocky structure; slightly hard, friable, sticky and plastic; few to common thin clay films on ped faces and pores; 35 percent cobbles and 20 percent gravel by volume; common medium and fine and few coarse roots; common medium and fine pores; neutral (pH 6.8); gradual wavy boundary.

B23t–27 to 32 inches; brown (7.5YR 5/4) extremely cobbly clay loam, brown (7.5YR 4/4) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, sticky and plastic; common thin clay films on ped faces and pores; 35 percent cobbles and 35 percent gravel by volume; few to common very fine and fine and few medium roots; common to many very fine and fine continuous tubular pores; neutral (pH 6.6); abrupt smooth boundary.

Cr–32 plus inches; reddish gray (5YR 5/2) weathered soft vesicular basalt which can be dug with a spade.

Reference Pedon Location: Lassen County, California, about 1700 feet east and 110 feet south of the NW corner of Section 11, T.38N., R.11E.

Range in Characteristics: Depth to a lithic contact of fractured basalt or andesite is 20 to 40 inches. The mean annual soil temperature at a depth of 20 inches is about 42 to 47°F. and fluctuates by more than 9°F. during the year. The soil temperature at the 20 inch depth exceeds 41°F. from May 15 through November 15 and exceeds 47°F. from June 15 through October 15 in most years. The 5 to 15 inch soil moisture control section is usually moist in all parts from November 20 through May 15, and dry in all parts from July 20 through October 20. The average coarse fragment content of the control section is 35 to 70 percent by volume, and also averages 24 to 35 percent clay.

The A horizon is 10 to 20 inches thick with dry color of 10YR 4/2, 4/3, 5/2, 5/3; 7.5YR 4/2, 4/4 and moist color of 10YR 2/2, 3/2, 3/3; 7.5YR 3/2. Texture is loam and contains 15 to 40 percent by volume rock fragments. Structure is granular to subangular blocky and soil pH is neutral to slightly acid.

The B horizon makes up the remainder of the soil depth with dry color of 10YR 4/2, 4/3, 4/4, 5/3, 5/4; 7.5YR 4/4, 5/4 and moist color of 10YR 3/2, 3/3, 3/4; 7.5YR 3/2, 3/4, 4/4. The upper parts of the argillic B horizon has mollic color and may include the whole soil depth. Texture is loam or clay loam and contains from 35 to 70 percent by volume rock fragments. Structure is subangular blocky and soil pH is neutral to slightly acid.

WAPAL FAMILY

The Wapal family consists of deep, somewhat excessively drained soils derived from andesite, tuff and obsidian. Permeability is moderately rapid. These soils are on 20 to 90 percent slopes and occur on upper sideslopes, ridges, knolls and deeply incised drainages of mountain uplands at 5500 to 7000 feet elevation. The climate is cool with 40 to 46°F mean annual air temperature and 20 to 30 inches annual precipitation which mainly falls as snow during winter. The frost free season is 60 to 90 days.

Taxonomic Class: Sandy-skeletal, mixed, frigid, Typic Xerorthents.

Reference Pedon: Wapal family gravelly fine sandy loam on a 30 percent north facing mountain sideslope at 5680 foot elevation under a young open stand of ponderosa pine with an understory of Ceonothus, rabbitbrush, big sagebrush and bunchgrass. Soil was dry throughout when described on 9/22/80. (Colors are for dry soil unless otherwise stated.)

01–1/2 to 0 inches; ponderosa pine needles and twigs.

A1–0 to 2 inches; gray (10YR 5/1) gravelly fine sandy loam, very dark gray (10YR 3/1) moist; single grain and weak fine granular structure; loose, non-sticky and non-plastic; 20 percent gravel by volume; many very fine and fine, common medium and coarse roots; neutral (pH 6.6); clear smooth boundary.

AC–2 to 6 inches; light yellowish brown (10YR 6/4) gravelly fine sandy loam, dark grayish brown (10YR 4/2) moist; single grain and weak fine granular structure; loose, non-sticky and non-plastic; 20 percent gravel by volume; many very fine and fine and common medium and coarse roots; neutral (pH 6.6); clear smooth boundary.

C1–6 to 24 inches; light gray (10YR 7/2) very gravelly loamy fine sand, brown (10YR 5/3) moist; weak fine subangular blocky structure parting to single grain; loose, non-sticky and non-plastic; 35 percent gravel by volume; common very fine, fine, medium and coarse roots; neutral (pH 6.8); gradual wavy boundary.

C2–24 to 35 inches; light gray (10YR 7/2) very gravelly loamy fine sand, grayish brown (10YR 5/2) moist; single grained to massive structure; loose, non-sticky and non-plastic; 55 percent gravel by volume; common very fine, fine and medium and few coarse roots; neutral (pH 6.8); gradual wavy boundary.

C3–35 to 60 inches; white (10YR 8/2) very gravelly loamy sand, light brownish gray (10YR 6/2) moist; single grained; loose, non-sticky and non-plastic; 40 percent gravel and 15 percent cobbles by volume; few very fine, fine and medium roots; neutral (pH 6.8).

Reference Pedon Location: Modoc County, California, about 40 feet upslope from road and about 2000 feet east and 2500 feet south of the NW corner of Section 14, T.45N., R.14E.

Range in Characteristics: Depth to bedrock is greater than 40 inches. Coarse fragments in the 10 to 40 inch control section average 35 to 60 percent by volume. The mean annual soil temperature at a depth of 20 inches is 41 to 47°F. and fluctuates by more than 9°F. during the year. The soil temperature at the 20 inch depth exceeds 41°F. from June 15 through October 15 in most years. The 6 to 18 inch soil moisture control section is usually moist in all parts from November 15 through May 30 and dry in all parts from August 1 through October 20.

The A horizons are 2 to 6 inches thick with dry color of 10YR 5/1, 5/2, 5/3, 6/2 and moist color of 10YR 3/1, 3/2, 3/3, 4/2, 4/2. Texture is fine sandy loam or sandy loam and contains from 15 to 45 percent by volume gravel size coarse fragments. Structure is granular and soil pH is neutral to slightly acid.

The C horizons make up the remainder of the soil with dry color of 10YR 6/3, 6/4, 7/2, 7/3, 8/2 and moist color of 10YR 4/2, 5/2, 5/3, 6/2, 6/3. Texture is loamy fine sand or loamy sand or sand and becomes sandier with depth and contains from 35 to 70 percent by volume coarse fragments primarily of the gravel size. It is massive or single grained and soil pH is neutral to slightly acid.

WENATCHEE FAMILY

The Wenatchee family consists of moderately deep, well drained soils that formed from material derived from ash, basalt and geologically recent pyroclastic pumice. Permeability is moderate. These soils are on 1 to 40 percent slopes and occur on gentle concave areas on basalt plateaus, basalt plateaus scarp breaks, or on sideslopes of mountain uplands at 4200 to 5500 feet elevation. The climate is cool with 45 to 50°F mean annual air temperature and 10 to 16 inches annual precipitation which mostly falls as snow during winter. The frost free season is 90 to 110 days.

Taxonomic Class: Fine-loamy, mixed, mesic, Xerollic Haplargids.

Reference Pedon: Wenatchee family gravelly coarse sandy loam on a nearly level basalt plateau at 4240 feet elevation under big sagebrush, rabbitbrush, and bunchgrass rangeland with a few scattered western juniper. Soil was moist below 9 inches when described on 5/22/80. (Colors are for dry soil unless otherwise stated.)

A1–0 to 5 inches; brown (10YR 5/2) gravelly coarse sandy loam, dark brown (10YR 3/3) moist; weak fine granular structure; soft, very friable, non-sticky and non-plastic; 30 percent less than 3/4 inch size gravel by volume, gravels are pumice; few very fine and fine roots; neutral (pH 6.6); abrupt smooth boundary.

C1–5 to 9 inches; very pale brown (10YR 7/3) extremely gravelly coarse loamy sand, light yellowish brown (10YR 6/4) moist; single grained; loose, non-sticky and non-plastic; 60 percent less than 3/4 inch size pumice gravel by volume; common very fine and fine roots; neutral (pH 6.8); abrupt smooth boundary.

IIA1b–9 to 15 inches; pale brown (10YR 6/3) fine sandy loam, dark brown (10YR 4/3) moist; moderate fine and medium subangular blocky structure; soft, friable, slightly sticky and non-plastic; 10 percent gravel by volume; few fine roots; many very fine and fine pores; neutral (pH 6.8); gradual wavy boundary.

IIB2tb–15 to 27 inches; yellowish brown (10YR 5/4) loam, dark yellowish brown (10YR 3/4) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few thin clay films on ped faces; 5 percent gravel by volume; common very fine roots; common very fine and fine, and few medium pores; neutral (pH 6.8); abrupt smooth boundary.

R–27 plus inches; hard fractured vesicular basalt.

Reference Pedon Location: Modoc County, California, about 500 feet south of the center of Section 7, T.45N., R.5E.

Range in Characteristics: Depth to bedrock is 20 to 40 inches. Clay content increases with depth and the control section averages 22 to 28 percent clay. Coarse fragments range from 5 to 35 percent by volume in the control section. The mean annual soil temperature at the 20 inch depth is about 47 to 53°F. and fluctuates by more than 9°F. during the year. The soil temperature at the 20 inch depth exceeds 41°F. from April 1 through December 1. The soils 4 to 12 inch moisture control section is usually dry in all parts from June 15 through November 15, and moist in all parts from December 15 through May 1.

A thin relatively undisturbed pumice overburden is present in soil map unit 140 and some pedons in unit 121 and 239. The pumice overburden consists of an approximate 900 year old pumice deposit of up to 12 inches and normally has an A and sometimes an A-C horizon development in the deeper deposits. The A horizon is 2 to 8 inches thick and has dry color of 10YR 5/2, 5/3, 6/2, 6/3, 6/4 and moist color of 10YR 3/2, 3/3, 4/2, 4/3. Texture is sandy loam, coarse sandy loam or coarse loamy sand and contains 30 to 60 percent by volume pumice gravel mainly of the less than 0.6 inch size. The pumice overburden C horizon, if present, has dry color of 10YR 6/3, 6/4, 7/2, 7/3, 8/2 or 8/3 and moist color of 10YR 5/4, 6/3, 6/4, 7/2 or 7/3. Texture is coarse sand or coarse loamy sand and contains 60 to 90 percent by volume pumice gravel mainly of the less than 1 inch size. The shallower pumice overburden areas are usually mixed with the older buried soil material. The pumice overburden pH is neutral to slightly acid.

The loamy textured mixed minerology soil beneath the pumice overburden, if present, has an A-B horizon development.

The A horizon is 3 to 6 inches thick and has dry color of 10YR 5/4, 6/3, 6/4; 7.5YR 5/4, 5/6 and moist color of 10YR 3/4, 4/2, 4/3; 7.5YR 3/4, 4/2. Texture is loam or fine sandy loam and contains 5 to 20 percent by volume

basalt gravel. Structure is subangular blocky and soil pH is neutral.

The B horizon has dry color of 10YR 5/4, 6/2, 6/3, 6/4 and moist color of 10YR 3/4, 4/2, 4/3, 4/4. Texture is loam or clay loam and contains from 5 to 35 percent by volume coarse fragments of basalt. Structure is subangular blocky and soil pH is neutral.

WOODHURST FAMILY

The Woodhurst family consists of deep, well drained soils formed in material derived from basalt. Permeability is moderate. These soils are on 10 to 30 percent slopes and occur on toeslopes and sideslopes of mountain uplands at 7000 to 8000 feet elevation. The climate is cold with 36 to 40°F mean annual air temperature and 25 to 35 inches annual precipitation which mostly falls as snow during winter. The frost free season is 40 to 70 days.

Taxonomic Class: Loamy-skeletal, mixed, Argic Pachic Cryoborolls.

Reference Pedon: Woodhurst family cobbly fine sandy loam on a 14 percent north facing sideslope at 7680 feet elevation under white fir and lodgepole pine forest. Soil was dry when described on 8/11/80. (Colors are for dry soil unless otherwise stated.)

01–3 to 0 inches; white fir and lodgepole pine needles, twigs and duff.

A11–0 to 5 inches; brown (10YR 4/3) cobbly fine sandy loam, very dark grayish brown (10YR 3/2) moist; moderate very fine and fine granular structure; slightly hard, very friable, slightly sticky and non-plastic, 30 percent cobbles, stones and gravel by volume; many very fine and fine, common coarse and medium roots; neutral (pH 6.8); clear smooth boundary.

A12–5 to 14 inches; brown (10YR 4/3) very stony loam, very dark grayish brown (10YR 3/2) moist; moderate fine and medium granular structure; slightly hard, very friable, slightly sticky and non-plastic; 20 percent stones; 20 percent cobbles and 15 percent gravel by volume; many very fine, fine, medium and coarse roots; neutral (pH 6.6); gradual wavy boundary.

A13-14 to 25 inches; yellowish brown (10YR 5/4) extremely stony loam, dark brown (10YR 3/3) moist; weak fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky and non-plastic 25 percent stones, 30 percent cobbles and 10 percent gravel by volume; common to many very fine, fine, medium and coarse roots; common very fine and fine and few medium pores; slightly acid (pH 6.4); gradual wavy boundary.

B21t–25 to 34 inches; yellowish brown (10YR 5/4) very stony loam, dark brown (10YR 3/3) moist; weak to moderate fine and medium subangular blocky structure; slightly hard, very friable, sticky and slightly plastic; few thin clay films on ped faces; 20 percent stones; 15 percent cobbles, and 15 percent gravel by volume; common very fine, fine, medium and coarse roots; few to common very fine and fine and few medium pores; slightly acid (pH 6.2); gradual wavy boundary.

B22t–34 to 60 inches; yellowish brown (10YR 5/4) very cobbly loam, dark brown (10YR 3/3) moist; moderate medium subangular blocky structure; slightly hard, very friable, sticky and slightly plastic; few to common thin clay films on ped faces and pores; 25 percent cobbles, 10 percent stones and 10 percent gravel by volume; common very fine and fine and few to common medium and coarse roots; few to common very fine and fine and few medium pores; medium acid (pH 6.0).

Reference Pedon Location: Modoc County, California, about 30 feet east of log landing and about 2500 feet west and 600 feet north of the SE corner of Section 3, T.40N., R.15E.

Range in Characteristics: Depth to a lithic contact is greater than 40 inches. The mean annual soil temperature at the 20 inch depth is about 36 to 42°F. The soil temperature at 20 inch depth exceeds 41°F. from July 1 through October 30 and exceeds 47°F. from July 20 through September 20 in most years. The mean summer soil temperature at 20 inches is less than 47°F. The 5 to 15 inch soil moisture control section is usually moist in all parts from November 1 through June 15 and dry in all parts from August 15 through October 10. The rock fragment content of the control section averages 35 to 65 percent by volume and the clay content averages 20 to 30 percent.

The A horizon is 20 to 34 inches thick. Soil color is 10YR 3/2, 3/3, 4/2, 4/3, 5/3, 5/4 dry and 10YR 2/2, 3/2, 3/3 moist. Texture is loam or fine sandy loam and contain 20 to 50 percent by volume rock fragments of basalt gravel, cobble or stone size fragments. Structure is granular or subangular blocky and soil pH is moderately acid to neutral.

The B horizon normally occupies the remainder to the soil with dry color of 10YR 4/4, 5/4, 5/6; 7.5YR 4/4, 5/4 and moist color of 10YR 3/2, 3/3, 3/4, 4/3, 4/4; 7.5YR 3/2, 3/4, 4/4; 5YR 3/3, 3/4. Texture is loam or clay loam and contains from 35 to 75 percent by volume rock fragments. Structure is subangular blocky and soil pH is medium acid to slightly acid.

WRENTHAM FAMILY

The Wrentham family consists of moderately deep, well drained soils formed in andesite and basalt. Permeability is moderate. These soils are on 10 to 35 0ercent slopes and occur on sideslopes and toeslopes of mountain uplands at 4600 to 5600 feet elevation. The mean annual air temperature is 44 to 49°F. The annual precipitation is 12 to 14 inches which mostly falls during winter as snow. The frost free season is 80 to 110 days.

Taxonomic Class: Loamy-skeletal, mixed, mesic, Pachic Haploxerolls.

Reference Pedon: Wrentham family very gravelly loam on an 18 percent southwest facing mountain sideslope at 5300 feet elevation under crested wheatgrass, Idaho fescue, cheatgrass and sandberg bluegrass rangeland. Soil was moist throughout when described on 4/7/81. (Colors are for dry soil unless otherwise stated.)

A11–0 to 4 inches; dark grayish brown (10YR 4/2) very gravelly loam, black (10YR 2/1) moist; weak to moderate medium and coarse granular structure; slightly hard, very friable, sticky and slightly plastic; 50 percent gravel by volume; many very fine and fine roots; neutral (pH 6.8); gradual wavy boundary.

A12–4 to 14 inches; grayish brown (10YR 5/2) very gravelly loam, very dark grayish brown (10YR 3/2) moist; weak to moderate medium and coarse granular structure; slightly hard, friable, sticky and slightly plastic; 40 percent gravel by volume; many very fine and common fine roots; neutral (pH 6.8); clear wavy boundary.

A13–14 to 23 inches; brown (10YR 5/3) very gravelly loam, dark brown (10YR 3/3) moist; moderate coarse granular to massive structure; slightly hard, friable, sticky and slightly plastic; 45 percent gravel by volume; common very fine and fine roots; few to common very fine and fine pores; neutral (pH 6.6); clear wavy boundary.

C1–23 to 33 inches; pale brown (10YR 6/3) very gravelly loam, dark brown (10YR 4/3) moist; massive; slightly hard, friable, sticky and slightly plastic; 55 percent gravel by volume; few to common very fine roots; few to common very fine and fine pores; slightly acid (pH 6.4); abrupt wavy boundary.

R–33 plus inches; fractured platy andesite.

Reference Pedon Location: Modoc County, California, about 2000 feet west and 800 feet north of the SE corner of Section 13, T.46N., R.6E.

Range in Characteristics: Depth to bedrock of platy andesite or basalt is 20 to 40 inches. The control section averages 20 to 24 percent clay and also averages 35 to 65 percent coarse fragments by volume. The mean annual soil temperature at 20 inches is about 47 to 52°F. and fluctuates by more than 9°F. during the year. The soil temperature at 20 inches exceeds 41°F. from April 1 through December 1 in most years. The 5 to 15 inch soil moisture control section is usually dry in all parts from June 15 through November 15 and moist in all parts from December 15 through May 1.

The A horizon is 20 to 32 inches thick and may include the whole soil depth with dry color of 10YR 4/2, 4/3, 5/2, 5/3, 5/4 and moist color of 10YR 2/1, 2/2, 3/2, 3/3. Texture is loam or fine sandy loam and contains from 20 to 60 percent by volume coarse fragments primarily of the gravel size. Structure is granular of subangular blocky and soil pH is neutral.

The C horizon, if present, has dry color of 10YR 6/3, 6/4, 7/2, 7/3 and moist color of 10YR 4/3, 5/2, 5/3 or 5/4. Texture is loam or sandy loam and contains from 45 to 80 percent by volume coarse fragments primarily of gravel size. It is massive and soil pH is neutral to slightly acid.

WUKSI FAMILY

The Wuksi family consists of moderately deep, somewhat excessively drained soils formed from ash, cinders, andesite, basalt and geologically recent pyroclastic pumice. Permeability is rapid. These soils are on 5 to 30 percent slopes and occur along the contact of cinder cones and basalt flows in the caldera area of the Medicine Lake Highlands at 6600 to 7000 feet elevation. The climate is cold with 38 to 40°F mean annual air temperature and 40 to 45 inches annual precipitation which mostly falls during winter as snow. The frost free season is 40 to 80 days.

Taxonomic Class: Ashy-skeletal, Typic Cryorthents.

Reference Pedon: Wuksi family gravelly coarse sand on a 6 percent south facing slope at 7000 feet elevation under red fir, lodgepole pine and western white pine forest with an understory of prostrate manzanita. (Colors are for dry soil unless otherwise stated.)

01–1 to 0 inches; fir and pine needles, twigs and duff.

C1–0 to 8 inches; light gray (10YR 7/2) gravelly coarse sand, light brownish gray (10YR 6/2) moist; single grained; loose, non-sticky and non-plastic; 20 percent pumice gravel by volume slightly acid; (pH 6.2) abrupt smooth boundary.

IIA1b–8 to 18 inches; pale brown (10YR 6/3) extremely gravelly loamy coarse sand, brown (10YR 4/3) moist; single grained; loose, non-sticky and non-plastic; 60 percent scoriacious andesite and pumice gravel by volume; slightly acid (pH 6.2); clear smooth boundary.

IIC1–18 to 32 inches; yellowish brown (10YR 5/4) extremely cobbly loamy coarse sand, dark yellowish brown (10YR 4/4) moist; single grained; loose, non-sticky and non-plastic; 30 percent cobbles and 50 percent gravel by volume of red scoriacious andesite; medium acid (pH 6.0).

R–32 plus inches; weathering in place fractured andesite and cinder rock.

Reference Pedon Location: Siskiyou County, California, about 40 feet north of road and about 600 feet west and 2400 feet south of the NE worner of Section 18, T.43N., R.4E.

Range in Characteristics: Depth to bedrock is 20 to 40 inches. Coarse fragments average 40 to 80 percent by volume in the control section. The mean annual soil temperature at a depth of 20 inches is about 40 to 42°F. and exceeds 41°F. from July 1 through October 30, and exceeds 47°F. from July 20 through September 25 in most years. The mean summer soil temperature at 20 inches is less than 47°F. The 6 to 18 inch soil moisture control section is usually moist in all parts from November 1 through June 15 and dry in all parts from August 20 through October 10 in most years.

The Wuksi family commonly has an approximate 900 year old pumice deposit of up to 8 inches in thickness. If present, the pumice deposit has dry color of 10YR 5/2, 5/3, 6/3, 6/4, 7/2, 7/3, 8/2, 8/3 and moist color of 10YR 4/2, 4/3, 4/4, 5/3, 6/2, 6/3, 7/2. Texture is loamy coarse sand or coarse sand and contains 20 to 50 percent by volume pumice gravel. It is single grained and soil pH is slightly acid to moderately acid.

The A horizon is 4 to 10 inches thick with dry color of 10YR 5/3, 5/4, 6/3, 6/4 and moist color of 10YR 3/4, 4/3, 4/4. Texture is loamy coarse sand or loamy sand and contains 35 to 70 percent by volume coarse fragments. It is single grained and soil pH is slightly acid to medium acid.

The C horizon has dry color of 10YR 5/4, 6/3, 6/4 and moist color of 10YR 4/4, 4/6, 5/3, 5/4. Texture is loamy coarse sand or coarse sand and contains 50 to 90 percent by volume coarse fragments. It is single grained and soil pH is slightly acid to medium acid.

XEROFLUVENTS

The Xerofluvents soils consist of moderately deep and deep, well drained soils that formed in alluvium on flood plains and fans and are normally adjacent to drainageways of intermittent or perennial streams. Slopes range from 1 to 10 percent and elevation ranges from 4,400 to 5,500 feet. Annual precipitation is 14 to 18 inches which falls mostly as snow during the winter and the mean annual air temperature is 45 to 50°F. The frost free season is 80 to 110 days.

Taxonomic Class: Xerofluvents

Reference Pedon: NOTE: The following pedon description is not necessarily intended to be the modal concept, but only as a reference pedon. Xerofluvents silty clay loam on a nearly level alluvial fan at 4,750 feet elevation under big sagebrush, rabbitbrush and bunchgrass rangeland. Soil was moist below 11 inches when described on 5/31/79. (Colors are for dry soil unless otherwise stated.)

A11-0 to 6 inches; dark gray (10YR 4/1) silty clay loam, very dark gray (10YR 3/1) moist; moderate medium prismatic structure which parts to moderate fine and medium angular blocky; hard, friable, sticky and plastic; many fine, very fine and few medium roots; common to many fine and very fine pores; neutral (pH 6.8); abrupt smooth boundary.

IIA12–6 to 11 inches; grayish brown (10YR 5/2) sandy loam, dark grayish brown (10YR 4/2) moist; massive; soft, very friable, slightly sticky and nonplastic; 5 percent gravel by volume; common to many fine, very fine and common medium roots; common fine and very fine pores; neutral (pH 7.2) abrupt smooth boundary.

IIA13–11 to 16 inches; grayish brown (2.5Y 5/2) coarse sandy loam, dark grayish brown (2.5Y 4/2) moist; massive; soft, very friable, non-sticky and nonplastic; 5 percent gravel by volume; common fine, very fine and medium roots; mildly alkaline (pH 7.4); abrupt smooth boundary.

IIIA14–16 to 26 inches; light brownish gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; massive; soft, very friable, non-sticky and non-plastic; common to many fine, very fine and common medium roots; common fine and very fine pores; mildly alkaline (pH 7.6); clear wavy boundary.

IIIA15–26 to 37 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; common fine, very fine and medium roots; common fine and very fine pores; moderately alkaline (pH 8.0); abrupt smooth boundary.

IVC–37 to 60 inches; very pale brown (10YR 7/3) sandy loam, brown (10YR 5/3) moist; moderate medium and coarse platy structure; slightly hard, friable, non-sticky and non-plastic; few fine and very fine roots; mildly alkaline (pH 7.4).

Reference Pedon Location: Modoc County, California, about 30 feet east of road and about 1,000 feet west and 2,300 feet south of the NE corner of Section 18, T.47N., R.13E.

Range in Characteristics: Depth to bedrock is greater than 20 inches. The control section averages 12 to 35 percent clay content and coarse fragments average 0 to 45 percent by volume. The mean annual soil temperature at a depth of 20 inches is about 47 to 52°F. and exceeds 41°F. from April 1 through December 1 and exceeds 47°F. from April 15 through November 15 in most years. The 5 to 15 inch soil moisture control section is usually moist in all parts from December 1 through May 1 and dry in all parts from July 1 through October 30. This soil is subject to spring flooding. The organic carbon content of the soil decreases irregularly with depth.

The A horizon may make up the whole soil depth with dry color of 10YR 4/1, 4/2, 4/3, 5/2, 5/3, 5/4, 6/2, 6/3; 2.5Y 5/2, 5/4 and moist color of 10YR 3/1, 3/2, 3/3, 3/4, 4/2, 4/3; 2.5Y 4/2. Texture is loamy sand, coarse sandy loam, sandy loam, loam, silt loam, silty clay loam, clay loam or clay and commonly occur in stratified lenses of 1 to 6 inches in thickness. Coarse fragments range from 0 to 60 percent by volume and are predominately of gravel size. Structure is platy, blocky, prismatic, massive or singly grained and soil pH is neutral to moderately alkaline.

The C horizon, if present, has dry color of 10YR 6/3, 6/4, 7/2, 7/3, 7/4; 2.5Y 6/4, 7/4 and moist color of 10YR 5/2, 5/3, 5/4, 6/3, 6/4; 2.5Y 5/2, 5/4, 6/4. Texture is sandy loam, coarse sandy loam, or loam and contains 0 to 40 percent by volume coarse fragments mainly of the gravel size. It is massive and soil pH is neutral to moderately alkaline.

YALLANI FAMILY

The Yallani family consists of deep, well drained soils formed from ash, cinder, andesite, basalt and geologically recent pumice. Permeability is moderately rapid, or, rapid over moderately rapid if a pumice overburden is present. These soils are on 5 to 60 percent slopes and occur on toeslopes, sideslopes, ridges and knolls of cinder cones and volcanic mountain uplands at 5300 to 7000 feet elevation. The climate is cool with 40 to 46°F mean annual air temperature and 20 to 45 inches annual precipitation which mostly falls as snow during winter. The frost free season is 60 to 90 days.

Taxonomic Class: Medial-skeletal, frigid, Andic Xerochrepts.

Reference Pedon: Yallani family gravelly sandy loam on a 5 percent south facing toeslope at 6440 foot elevation under a dense white fir forest with a sparce understory of current sp., and bunchgrasses. Soil was moist below about 10 inches when described on 7/10/80. (Colors are for dry soil unless otherwise stated.)

01–3 to 0 inches; mostly decomposed white fir needles and twigs.

A1–0 to 4 inches; brown (10YR 4/3) gravelly sandy loam, dark brown (10YR 3/3) moist; fine granular; soft, loose, non-sticky and non-plastic; 20 to 25 percent mixed pumice and basalt gravel by volume; common very fine, fine, and medium roots; weakly smeary; slightly acid (pH 6.4); clear smooth boundary.

B21–4 to 18 inches; brown (10YR 5/3) extremely cobbly fine sandy loam, dark yellowish brown (10YR 3/4) moist; weak fine and medium subangular blocky structure; soft, very friable non-sticky and non-plastic; 5 to 10 percent cinder gravel, 20 percent basalt gravel and 40 percent basalt cobbles by volume; common very fine, fine, medium and coarse roots; few fine pores; weakly to moderately smeary; slightly acid (pH 6.4); gradual wavy boundary.

B22–18 to 39 inches; yellowish brown (10YR 5/4) extremely cobbly loam, dark yellowish brown (10YR 4/4) moist; weak to moderate fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky and non-plastic; very few thin clay films on pores and ped faces; 20 percent cinder gravel, 20 percent basalt gravel and 30 percent basalt cobbles by volume; common very fine, fine, medium and coarse roots; few fine pores; weakly to moderately smeary; neutral (pH 6.6); clear wavy boundary.

B3–39 to 60 inches; light olive brown (2.5Y 5/4) extremely cobbly loam, dark yellowish brown (10YR 4/4) moist; moderate fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky and non-plastic; very few thin clay films on pores and ped faces; 20 percent cinder gravel, 20 percent basalt gravel, and 40 percent basalt cobbles by volume; common very fine and fine and few medium and coarse roots; weakly to moderately smeary; neutral (pH 6.6).

Reference Pedon Location: Siskiyou County, California, about 1800 feet west and 2500 feet south of the NE corner of Section 26, T.43N., R3E.

Range in Characteristics: Depth to bedrock is greater than 40 inches. The mean annual soil temperature at a depth of 20 inches is about 42 to 47°F. from May 15 through November 15 and exceeds 47°F. from June 15 through October 15 in most years. The 5 to 15 inch soil moisture control section is moist in all parts from about November 15 through May 30 and dry in all parts from about August 1 through October 20 in most years. The average rock fragment content in the 10 to 40 inch control section is 35 to 80 percent by volume and consists predominately of gravel and cobble size with few stones. The bulk density of the soil fine earth fraction is estimated to be between 0.50 and 0.95 at 1/3 bar water tension and the ratio of measured clay to 15 bar water is less than 1.25 normally in all parts of the upper 30 inches of soil.

In some units where the soil is mapped it has an approximate 900 year old pumice deposit of 6 to 20 inches thick. This deposit is always less than half the thickness of the underlying combined A and B horizons. The pumice overburden, if present, consists of an A, or an A-C horizon development in the deeper deposits. If present the pumice A horizon has dry color of 10YR 5/1, 5/2, 5/3, 6/2, 6/3 and moist color of 10YR 3/2, 3/3, 3/4, 4/2, 4/3 and may be up to 8 inches thick. Texture is coarse loamy sand or coarse sandy loam and contains from 35 to 60 percent by volume pumice gravel. It is single grained and soil pH is moderately acid to slightly acid. The pumice overburden C horizon, if present,

has dry color of 10YR 7/2, 7/3, 8/2, 8/3 and moist color of 10YR 5/2, 6/2, 6/3, 7/2. Texture is coarse loamy sand or coarse sand and contains from 50 to 90 percent by volume pumice gravel. It is single grained and soil pH is moderately acid to slightly acid.

The more loamy textured soil beneath the pumice overburden, if present, has an A-B horizon development.

The A horizons are 4 to 9 inches thick and have dry color of 10YR 4/2, 4/3, 5/2, 5/3, 5/4, 6/3; 7.5YR 6/4 and moist color of 10YR 3/2, 3/3, 3/4, 4/2, 4/3; 7.5YR 3/4, 4/2, 4/4. Textures are coarse sandy loam or sandy loam and contain 20 to 50 percent by volume cobbles and gravel. Mollic colors do not extend beyond 6 inches from the soil surface. Structure is granular or subangular blocky and soil pH is medium acid to slightly acid.

The B horizons have dry color of 10YR 5/3, 5/4, 6/4, 6/6; 7.5YR 6/4; 2.5Y 5/4, 6/4 moist color of 10YR 3/4, 4/4, 4/6, 5/4; 7.5YR 4/4. Textures are sandy loam, coarse sandy loam or loam and contain from 40 to 80 percent by volume cobble, stone and gravel size rock fragments. Structure is subangular blocky and soil pH is medium acid to neutral.

ZYNBAR FAMILY

The Zynbar family consists of moderately deep and deep, well drained soils derived from ash, cinder, andesite and basalt. Permeability is moderately rapid. These soils are on 2 to 35 percent slopes and occur on toeslopes and sideslopes of cinder cones, and volcanic mountain uplands at 5500 to 6600 feet elevation. The climate is cool with 42 to 46°F mean annual air temperature and 30 to 40 inches annual precipitation which mostly falls as snow during winter. The frost free season is 70 to 100 days.

Taxonomic Class: Medial, frigid, Entic Dystrandepts.

Reference Pedon: Zynbar family gravelly coarse sandy loam on a 32 percent southwest facing smooth mountain sideslope at 5780 feet elevation under dense buckbrush, greenleaf manzanita and chinquapin and a few scattered encroaching white fir and ponderosa pine. Soil was moist below 11 inches when described on 7/24/80. (Colors are for dry soil unless otherwise stated.)

A11-0 to 5 inches; brown (10YR 4/3) gravelly coarse sandy loam, dark brown (10YR 3/3) moist; weak fine granular structure; soft, very friable, non-sticky and non-plastic; 25 percent gravel by volume of cinder with some pumice; common very fine and fine roots; weakly smeary and weakly thixotropic; neutral (pH 6.6); gradual smooth boundary.

A12–5 to 11 inches; dark yellowish brown (10YR 4/4) gravelly coarse sandy loam, dark yellowish brown (10YR 3/4) moist; weak fine granular structure; soft, very friable, non-sticky and non-plastic; 20 percent cinder gravel by volume; common fine and medium roots; moderately smeary and moderately thixotropic; neutral (pH 7.0); clear smooth boundary.

B21–11 to 16 inches; yellowish brown (10YR 5/6) gravelly coarse sandy loam, dark yellowish brown (10YR 3/6) moist; weak fine and medium granular and subangular blocky structure; soft, very friable, non-sticky and non-plastic; 15 percent gravel by volume; few fine and medium roots; moderately smeary; neutral (pH 7.2); clear smooth boundary.

B22–16 to 34 inches; yellowish brown (10YR 5/6) gravelly coarse sandy loam, dark yellowish brown (10YR 4/4) moist; weak fine and medium subangular blocky structure; soft, very friable, non-sticky and non-plastic; 15 percent gravel by volume; moderately smeary; neutral (pH 6.8).

R–34 inches; hard fractured basalt.

Reference Pedon Location: Siskiyou County, California, about 450 feet west and 800 feet south of the NE corner of Section 3, T.42N., R.4E.

Range in Characteristics: Depth to bedrock is greater than 30 inches. The mean annual soil temperature at a depth of 20 inches is 43 to 47°F. The 4 to 12 inch soil moisture control section is usually moist in all parts from about November 15 through May 30. It is dry in all parts from about August 1 through October 20. The soil temperature at 20 inches exceeds 41°F. from May 15 through November 15 and exceeds 47°F. from June 15 through October 15 in most years. The average content of coarse fragments in the control section is 15 to 35 percent by volume. The bulk density of the soil fine earth fraction is estimated to be between 0.80 and 0.95 at 1/3 bar water tension and the ratio of measured clay to 15 bar water is less than 1.25 normally in all parts of the upper 30 inches of soil. The estimated base saturation is between 30 and 50 percent by the ammonium acetate method normally throughout the upper 30 inches of soil. The soil has weak to moderate smeary consistence throughout.

The A horizon is 6 to 13 inches thick with dry colors of 10YR 4/3, 4/4, 5/3, 5/4, 6/3; 7.5YR 5/4, 6/4 and moist color of 10YR 3/2, 3/3, 3/4, 4/3, 4/4; 7.5YR 3/4. The mollic color, if present, does not extend below 6 inches. Texture is coarse sandy loam, or sandy loam and contains 10 to 35 percent gravel size coarse fragments. Structure is granular of subangular blocky and soil pH is slightly acid to neutral.

The B horizon makes up the remaining soil and has dry color of 10YR 5/4, 5/6, 6/4, 6/6; 7.5YR 5/4, 5/6, 6/4 and moist color of 10YR 3/4, 4/6, 4/4, 4/6; 7.5YR 3/4, 4/4, 4/6. Texture is coarse sandy loam, sandy loam and commonly grades to a coarse loamy sand with depth and contains from 15 to 45 percent by volume coarse fragments. Structure is subangular blocky or granular and soil pH is medium acid to neutral.

Formation of the Soils

This section discusses the factors of soil formation, relates them to the formation of soils in the survey area, and explains the processes of soil formation.

Soil is a mixture of rocks and minerals, organic matter, and water and air, in varying proportions. The factors that cause soils to differ are (1) the physical and chemical composition of the parent material; (2) the climate under which the soil material has accumulated and existed since accumulation; (3) biological forces; (4) relief, or lay of the land; and (5) the length of time the forces of development have acted on the soil material. The relative importance of each factor differs from place to place, but generally the interaction of all the factors determines the kind of soil that forms in any given place.

Parent Material

Generally, two types of rock, sedimentary and igneous, are dominant in the Modoc Forest. The sedimentary formations are remnants of prehistoric lake sediments. Volcanic rocks commonly cap these sedimentary formations or have been uplifted to form plateaus and mountains.

Parent material exerts considerable influence on soil formation. The influence of parent material is greatest in recently deposited materials and decreases with weathering and horizon differentiation. Recent alluvium, derived mostly from basalt, andesite, obsidian, and some pyroclastic rocks, is frequently stratified, is commonly poorly drained, is affected by saline or alkali salts, and has little or no horizon differentiation below the surface layer.

Old terraces and alluvial fan deposits, which are the older parts of the landscape, are derived from rocks similar to those contributing to the recent alluvium. Soils that formed in these materials have a clay subsoil and indurated pans or carbonate accumulations. The influence of parent materials on these soils has been modified and lessened by soil genesis.

The high uplands of the Modoc Forest have been dissected, but remnants of old landscapes are still evident. In places where hard tuff bedrock is prominent, there are areas of Tuff outcrop and the shallow, relatively infertile and easily eroded Casuse family soils. In other places where basalt bedrock is prominent there are areas of Rock outcrop and the shallow, clayey Deven family soils. In areas where older, more weathered basalt is prominent, the soils are deeper and have duripans and clay subsoil. The Puls family soils are an example of duripan soils.

Climate

Climate (temperature and precipitation) strongly affects soil formation through its influence on biological activity. Heat and moisture control the kind and amount of vegetation that grows, the rate at which organic matter decomposes, and the rate at which minerals weather. Moisture controls the removal or accumulation of soil material in the different soil horizons and the removal from the soil.

Temperature and precipitation in the survey area vary according to elevation. In general, temperatures are warmer at the lower elevations in valleys and are colder at the higher elevations on uplands. The amount of rainfall is higher in the upland areas and lower in the valleys. The valleys also receive some runoff from the uplands.

The distribution of moisture and temperature affects the kind of soils in the area. The climate of the Modoc Forest is characterized by cold, moist winters and dry, warm summers. A typical sequence of moisture and temperature is as follows: The first autumn rains wet the soil. Then snow falls before the ground freezes to any appreciable depth. Temperatures are too cold for plant growth. Precipitation is stored in the form of snow. The accumulated snow melts gradually in spring and combines with spring rain to produce a period of maximum moisture and soil leaching. In some years, rains and high temperatures early in spring result in rapid snow melt and high runoff. As temperatures increase, plant growth becomes rapid. Plants soon require more water that is supplied by precipitation, and the moisture stored in the soil is used. When this stored moisture is depleted, about June 20th to July 10th, most plant growth stops. From this date until the next autumn rains, little plant growth takes place. Detailed climatic data for the area are in the section "General Nature of the Area."

The depth to a zone of carbonate accumulation represents the depth to which the soil has been leached. This varies from year to year. The zone of maximum weathering and translocation of clay occurs where there is sufficient moisture. This is generally where the clayey subsoil horizon occurs. The depth to a silica cemented hardpan also generally represents the depth of leaching. Many

hardpans are just above a gravelly or cobbly layer. The difference in pore size between the gravelly or cobbly layers and the layers above affects the movement and retention of moisture. Most of the soils in the survey area have had relatively little leaching throughout the profile. The base saturation values tend to be high, and the exchangeable bases are mainly calcium, magnesium, sodium, and potassium.

Freezing and thawing generally occur late in fall, in winter, and early in spring, except when the ground is covered by snow. The effects of frost action are evidenced by heaving of plants, formation of thin surface cracks, segregation of coarse particles, and movement of saturated surface soil.

Biological Activity

Plants, animals, insects, bacteria, and fungi are important in the formation of soils. Vegetation is of particular importance. It affects the accumulation of organic matter in the surface layer and, through the penetration and decay of roots, throughout the soil. Organic matter is the energy source for the biological activity in the soil.

In the poorly drained soils the water-tolerant vegetation produces a large amount of organic matter. These soils have a thick, dark surface layer. Areas of sagebrush and grass or juniper, sagebrush, and grass produce less organic matter than other areas and the soils have a thinner surface layer.

The north slopes are protected from direct sunlight. Water utilization by plants is more efficient because evaporation is less. The soils on north exposures support more vegetation. The vegetation adds organic material to the soil and influences the color, structure, and physical condition of the soil. In this survey area, soils forming on north aspects are more prone to have mollic epipedon.

The kind of vegetation, by its influence on organic-matter content, has a strong influence on soil formation. Soils that formed under conifers, such as the Gleason and Lyonman Family soils, have a thin layer of undecomposed leaf litter on top of the mineral soil. This leaf litter, which provides a large proportion of the organic-matter content of these soils is low in bases.

Well drained soils generally have an abundant population of burrowing animals such as ground squirrels. These animals are active in mixing organic matter into the soil, and through their burrowing activities, they disturb soil horizon formation and increase the movement of air and water in the soil.

Shrubs on Packwood Family soils grow mostly on small mounds. These mounds are a result of soil blowing and the accumulation of organic matter under the shrubs.

Time

Soil formation needs time. The soils in the survey area differ in both age and maturity. Age refers to the length of time the soil has been forming; maturity refers to the degree that well defined genetically related horizons have formed and are approaching equilibrium with the environment. A soil may be old in years but young in development, if the parent material is very resistant to weathering. The geologic age of the parent rock, therefore, is not necessarily related to the age of the soil

The relationship between soil profiles and the relative age of the landscape on which they are located gives us some idea of how long it takes horizons to form. The recent landscapes, such as lake or basin deposits, stream alluvium, and recent alluvial fans, have soils which are mostly young in years and immature. These soils have had only enough time for organic matter to accumulate in their surface layer. The older landscapes like the intermediate alluvial fans, older alluvial fans, near-shore deposits, and lake deposits of Plio-pleistocene age have had time to weather and to form a clay subsoil. Profiles of the older soils are more mature. Some of the soils have had time to form a hardpan or zones of lime accumulation. Upland soils, which are mostly on the oldest landforms, almost all have some degree of horizon formation and a clay subsoil or hardpan. An exception is the Gleason soils. The Puls soils are the most mature of the soils on uplands.

A few soils in the survey area are on older landscapes but can be considered relatively immature. These soils have high shrink-swell properties. They have formed only a deep surface layer with accumulations of organic matter, and their cracking and churning has prevented the formation of other horizons. These soils are in horizon genesis, although they are mature in one sense by being in equilibrium with their environment (17).

Relief

Relief, or the shape of the landscape, influences formation of soils through its effect on drainage, erosion, plant cover, and soil temperature. Soils in depressional areas or along the borders of the Pit River have increased amounts of water and are somewhat poorly drained. The higher areas within the valley lack this additional water and are better drained. The upland areas are either flat plateaus or mountainous uplands. The flat plateaus have less runoff than the mountainous areas and are less

easily eroded. North-facing slopes receive less radiant energy from the sun and are cooler than south-facing slopes. This affects the vegetation and frequently results in formation of a different soil. Microrelief in the form of mounds and intermounds is common in certain parts of the Modoc Forest. These mounds occur at random on slopes of less than about 5 percent. There is marked orientation of the mounds up and down slopes that are much more than 15 percent.

References

(1) American Association of State Highway (and Transportation) Officials. 1970. Standard Specifications for highway materials and methods of sampling and testing. Ed. 10, 2 vol., illus.

(2) Alexander, Earl B. (EBA), 2/16/81. Relative Chance for Survival of Planted Conifer Seedlings Based on Physical Site factors in California. Unpublished, USDA Forest Service, Region five. 21 pp. illus., Tables.

(3) American Society for Testing and Materials. 1974. Method for Classification of soils for engineering purposes. ASTM Stand. D 2487-69. 1974 Annual Book of ASTM Standards, Part 19, 464 pp., illus.

(4) Bailey, Edgar H., 1966. Geology of Northern California. Bulletin 190. California Division of Mines and Geology, Ferry Building, San Francisco, Calif. 508 p.p., illus.

(5) California Division of Highways, Materials and Research Department, "Method of Test for Determining of the Resistance "R " Value of Treated and Untreated bases, Subbases and Basement Soils by the Stabilometer," Test Method No. Calif. 301-F (includes thickness design procedures).

(5a) Bates, Robert L. and Julia A. Jackson (Editors). 1980. Glossary of Geology. Am. Geol. Inst., Falls Church, Virginia. 749 pp.

(6) Elford, Robert C. and Max R. McDonough. 1965. The Climate of Modoc County. 8 pp. illus., tables.

(7) Laux, G.M., March 12, 1970. Geology of the Modoc National Forest. Unpublished. U.S. Forest Service, Modoc National Forest, Alturas, Calif. 7 pp., illus.

(8) Pease, Robert W. 1965. Modoc Country - A Geographic Time Continuum on the California Volcanic Tableland. University of California Publications in Geography, Volume 17. University of California Press, Berkeley and Los Angeles.

(9) United States Department of Agriculture. Sept. 2, 1977. Estimating Sheet-Rill Erosion and Sediment Yieled on Disturbed Western Forests and Woodlands. Soil Conservation Service, West Technical Service Center, Portland, Oregon. Technical Note, Woodland #10. 33 pp., Illus., tables.

(10) United States Department of Agriculture. 1976. Field Manual, Soil Resource Inventory. Forest Service, San Francisco, California. 190 pp., illus.

(11) United States Department of Agriculture. July 13, 1976. National Range Handbook. Soil Conservation Service, Washington, D.C.

(12) United States Department of Agriculture. Aug. 30, 1978. National Range Handbook, California Notice Number 1. Soil Conservation Service, 2828 Chiles Rd., Davis, Calif. 6 pp.

(13) United States Department of Agriculture. July, 1983. National Soils Handbook. Soil Conservation Service, Washington, D.C.

(14) United States Department of Agriculture. May, 1981. Soil Survey Manual, Soil Conservation Service, Washington D.C.

(15) United States Department of Agriculture. 1951. Soil Survey Manual. USDA Handbook 18, 503 pp., illus. (Supplements replacing pp. 173-188 issued May 1962).

(16) United States Department of Agriculture. 1975. Soil Taxonomy: A basic system of soil classification for making and interpreting soil surveys. Soil Conservation Service, USDA Handbook 436, 754 pp., illus.

(17) United States Department of Agriculture. 1980. Soil Survey of Modoc County, California, Alturas Area. Soil Conservation Service, Washington, D.C.

Glossary

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alkali (sodic) soil. Soil having so high a degree of alkalinity (pH 8.5 or higher), or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Alluvial fan. The fanlike deposit of a stream where it issues from a gorge upon a plain or of a tributary stream near or at its junction with its main stream.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Amorphous material. Noncrystalline constituents that either do not fit the definition of allophane or it is not certain if the constituent meets allophane criteria.

Andesite. A dark-colored, fine-grained extrusive rock that, when porphyritic, contains phenocrysts composed primarily of zoned sodic plagioclase (esp. andesine) and one or more of the mafic minerals (e.g., biotite, hornblende, pyroxene), with a groundmass composed generally of the same minerals as the phenocrysts, although the plagioclase may be more sodic and quartz is generally present; the extrusive equivalent of diorite. Andesite grades into latite with increasing alkali feldspar content, and into dacite with more alkali feldspar and quartz.

Animal-unit-month (AUM). The amount of forage required by one mature cow of approximately 1,000 pounds weight, with or without a calf, for 1 month.

Ash. Uncemented volcanic ejecta less than 4.0 mm in diameter.

Association, soil. A group of soils or miscellaneous areas geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Basalt [ign]. A general term for dark-colored mafic igneous rocks, commonly extrusive but locally intrusive (e.g. as dikes), composed chiefly of calcic plagioclase and clinopyroxene; the fine-grained equivalent of gabbro. Nepheline, olivine, orthopyroxene, and quartz may be present in the CIPW norm, but not all simultaneously: nepheline and olivine can occur together, as can olivine and orthopyroxene, and orthopyroxene and quartz, but nepheline does not coexist with orthopyroxene or quartz, nor quartz with nepheline or olivine.

Base saturation. The degree to which material having cation exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation exchange capacity.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Breaks. The steep to very steep broken land at the border of an upland summit that is dissected by ravines.

Bulk density. The mass of dry soil per unit bulk volume; usually measured as grams per cubic centimeter.

Caldera. A large, basin-shaped volcanic depression, more or less circular in form. Two basic types are from explosion or collapse.

Canopy. The leafy crown of trees or shrubs (See Crown).

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity, but is more precise in meaning.

Cinder. A juvenile vetric vesicular pyroclastic fragment that falls to the ground in an essentially solid condition.

Cinder cone. A conical hill formed by the accumulation of cinders and other pyroclasts, normally of basaltic or andesitic composition. Steepness of the slopes depends on coarseness of the ejecta, height of eruption, wind velocity, and other factors, but is normally greater than 10 degrees.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter, in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Clay skin. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay film.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Climax plant community. The plant community on a given site that will be established if present environmental conditions continue to prevail and the site is properly managed.

Coarse fragments. Mineral or rock particles larger than 2 millimeters in diameter.

Coarse textured soil. Sand or loamy sand.

Cobble (or cobblestone). A rounded or partly rounded fragment of rock 3 to 10 inches (7.6 to 25 centimeters) in diameter.

Colluvium. Soil material, rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

Compaction. The packing together of soil particles by forces exerted at the soil surface, resulting in increased soil density.

Complex, soil. A map unit of two or more kinds of soil or miscellaneous areas in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are:

Loose. Noncoherent when dry or moist; does not hold together in a mass.

Friable. When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm. When moist, crushes under moderate pressure between thumb and forefinger, but resistence is distinctly noticeable.

Plastic. Readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky. Adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard. When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft. When dry, breaks into powder or individual grains under very slight pressure.

Cemented. Hard; little affected by moistening.

Continental climate. Climate, as that in the interior of a continent, characterized by considerable variation in temperature and in other weather conditions.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 inches.

Crown. The upper part of a tree or shrub, including the living branches and their foliage.

Decreasers. The most heavily grazed climax range plants. Because they are the most palatable, they are the first to be destroyed by overgrazing.

Drainage, surface. Runoff, or surface flow of water, from an area.

Durinodes. Silica-cemented soil aggregates.

Duripan. A subsurface horizon that is so cemented by silica that fragments from this horizon will not slake after prolonged soaking in water or hydrochloric acid. A duripan can also contain accessory cements, for example, calcium carbonate.

Effervescence. The fizz that results when diluted hydrochloric acid is applied to soil material that contains free carbonates.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature; for example, fire that exposes the surface.

Evapotranspiration. Water transpired by vegetation plus that evaporated from the soil.

Extrusive rock. Igneous rock derived from deep-seated molten matter (magma) emplaced on the earth's surface.

Fault. A fracture or fracture zone along which there has been displacement on one side with respect to the other.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fibric soil material (peat). The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called normal field capacity, normal moisture capacity, or capillary capacity.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artifically.

Fluvial. Of or pertaining to rivers; produced by river action, as a fluvial plain.

Foothill. A steeply sloping upland that has relief of as much as 1,000 feet (or 300 meters) and fringes a mountain range or high-plateau escarpment.

Forb. Any herbaceous plant not a grass or a sedge.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

Geomorphology. The study of landforms as they relate to geologic composition and history.

Gravel. Rounded or angular fragments of rock as much as 3 inches (2 milimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Habitat. The natural abode of a plant or animal; refers to the kind of environment in which a plant or animal normally lives, as opposed to the range or geographical distribution.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material is sandy, loamy, or clayey and is cemented by iron oxide, silica, calcium carbonate, or other substance.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an upper case letter represents the major horizons. Numbers or lower case letters that follow represent subdivisions of the major horizons.

An explanation of the subdivisions is given in the Soil Survey Manual. The major horizons of mineral soil are as follows:

O horizon. An organic layer of fresh and decaying plant residue.

A horizon. The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a R horizon.

B horizon. The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon. The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying soil material. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, the number 2 precedes the letter C.

R layer. Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but it can be directly below an A or a B horizon.

Igneous rock. Rock formed by solidification from a molten or partially molten state. Major varieties include plutonic and volcanic rock. Examples are andesite, basalt, and granite.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Increasers. Species in the climax vegetation that increase in amount as the more desirable plants are reduced by close grazing. Increasers commonly are the shorter plants and the less palatable to livestock.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in iches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Invaders. On range, plants that encroach into an area and grow after the climax vegetation has been reduced by grazing. Generally, plants invade following disturbance of the surface.

Knoll. A small, low, rounded hill rising above adjacent landforms.

Landslide. The rapid downhill movement of a mass of soil and loose rock, generally when wet or saturated. The speed and distance of movement, as well as the amount of soil and rock material, vary greatly.

Lava flow. A lateral, surficial outpouring of molten lava from a vent or a fissure; also, the solidified body of rock that is so formed.

Lava plateau. A broad, elevated tableland or flat-topped highland, usually many hundreds or thousands of square kilometers in extent, underlain by a thick succession of lava flows, most of which are tholeiitic basalts and the product of fissure eruption. Syn: basaltic plateau.

Leaching. The removal of soluable material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Low strength. The soil is not strong enough to support loads.

Microrelief. Minor surface irregularities in the land surface, for example, low mounds or shallow depressions.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence,

color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance few, common, and many; size fine, medium, and coarse; and contrast faint, distinct, and prominent. The size measurements are of the diamter along the greatest dimension. Fine indicates less than 5 millimeters (about 0.2 inch); medium, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and coarse, more than 15 millimeters (about 0.6 inch).

Mountain. A natural elevation of the land surface, rising more than 1,000 feet above surrounding lowlands, commonly of restricted summit area (relative to a plateau) and generally having steep sides and considerable bare-rock surface. A mountain can occur as a single, isolated mass or in a group forming a chain or range.

Munsell notation. A designation of color by degrees of the three simple variables hue, value, and chroma. For example, a notation of 10YR 6/4 is color in hue of 10YR, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil).

Nurtient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Obsidian. A black or dark-colored volcanic glass, usually of rhyolite composition, characterized by conchoidal fracture. It is sometimes banded or has microlites.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Overburden. In this survey area relates to a relatively recent deposit of pyroclastic volcanic pumice of 2 to 40 inches of thickness which has been deposited over an older more developed soil.

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, hardpan, fragipan, claypan, plowpan, and traffic pan.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Peat. Unconsolidated material, largely undecomposed organic matter, that has accumulated under excess moisture. (See Fibric soil material).

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil". A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 20 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil.

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil).

Physiographic position. Broad landforms based on the physical features of the landscape.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Plateau. An extensive upland mass with relatively flat summit area that is considerably elevated (more than 100 meters) above adjacent lowlands and separated from them on one or more sides by escarpments.

Potential native plant community. The plant community on a given site that will be established if present environmental conditions continue to prevail and the site is properly managed. (See climax plant community).

Potential rooting depth (effecitve rooting depth). Depth to which roots could penetrate if the content of moisture in the soil were adequate. The soil has no properties restricting the penetration of roots to this depth.

Prescribed burning. The application of fire to land under such conditions of weather, soil moisture, and time of day as presumably will result in the intensity of heat and spread required to accomplish specific forest management, wildife, grazing, or fire hazard reduction purposes.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Proper grazing use. Grazing at an intensity that maintains enough cover to protect the soil and maintain or improve the quantity and quality of the desirable vegetation. This increases the vigor and reproduction of the key plants and promotes the accumulation of litter and mulch necessary to conserve soil and water.

Pumice. A light-colored vesicular glassy rock commonly having the composition of rhyolite. It is often sufficiently buoyant to float on water and is economically useful as a lightweight aggregate and as an abrasive. The adjectival form, pumiceous, is usually applied to pyroclastic ejecta.

Pyroclastic. A general term applied to rocks formed from volcanic material that has been explosively or aerially ejected from a volcanic vent.

Rangeland. Land on which the potential natural vegetation is predominately grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Range condition. The present composition of the plant community on a range site in relation to the potential natural plant community for that site. Range condition is expressed as excellent, good, fair, or poor on the basis of how much the present plant community has departed from the potential.

Range site. An area of rangeland where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. A range site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other range sites in kind or proportion of species or total production.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as:

pH
Extremely acid below 4.5
Very strongly acid 4.5 to 5.0
Strongly acid 5.1 to 5.5
Medium acid 5.6 to 6.0
Slightly acid 6.1 to 6.5
Neutral 6.6 to 7.3
Mildly alkaline 7.4 to 7.8
Moderately alkaline 7.9 to 8.4
Strongly alkaline 8.5 to 9.0
Very strongly alkaline 9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered, or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rill. A steep sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rock fragments. Rock or mineral fragments having a diameter or 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil texture class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and runoff water.

Shield volcano. A volcano in the shape of a flattened dome, broad and low, built by flows of very fluid basaltic lava or by rhyolitic ash flows. Cf: lava shield; ignimbrite shield. Syn: lava dome; basaltic dome.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silica. A combination of silicon and oxygen. The mineral form is called quartz.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Site class. A grouping of site indexes into 5 to 7 production capability levels. Each level can be represented by a site curve.

Site curve (100-year). A set of related curves on a graph that show the average height of dominant and codominate trees for a range of ages on soils that differ in productivity. Each level is represented by a curve. The basis of the curves is the height of dominant and codominant trees that are 100 years old or are 100 years old at breast height.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slippage. Soil mass susceptible to movement downslope when loaded, excavated, or wet.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distnace, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Smeariness. The extent to which a soil exhibits smeariness determines whether or not it is thixotropic. Thixotrophy is the property exhibited by various gels of becoming fluid when disturbed and of setting again to a gel when allowed to stand. Thixotrophy apparently is the result of structure that, if broken down, can rebuild itself. The breakdown may be caused by any of several actions - agitation, shearing, even ultrasonic waves. In evaluating thixotropic soil material, force is applied to a standard test specimen at field moisture capacity until it smears. Classes are based on the degree of force applied.

Weakly smeary: Under moderately strong force between thumb and forefinger, the soil material changes suddenly to fluid, the fingers skid, and the soil smears. After the soil smears, little or no free water remains on the fingers.

Moderately smeary: Under moderate force between thumb and forefinger, the soil material changes suddenly to fluid, the fingers skid, and the soil smears. After the soil smears, little or no free water remains on the fingers.

Strongly smeary: Under slight force between thumb and forefinger, the soil material suddenly changes to fluid, the fingers skid, and the soil smears and is very slippery. After the soil smears, free water is easily seen on the fingers

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than two millimeters (mms) in equivalent diameter and ranging between specified size limits. The names and sizes of

separates recognized in the United States are as follows:

Very coarse sand 2.0 to 1.0 mms
Coarse sand 1.0 to 0.5
Medium sand 0.5 to 0.25
Fine sand 0.25 to 0.10
Very fine sand 0.10 to 0.05
Silt 0.05 to 0.002
Clay less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter if rounded or 6 to 15 inches (15 to 38 centimeters) in length if flat.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are platy (laminated), prismatic (vertical axis of aggregates longer than horizontal), columnar (prisms with rounded tops), blocky (angular or subangular), and granular. Structureless soils are either single grained (each grain by itself, as in dune sand) or massive (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Surface layer. As used in this survey refers to the a horizon and the organic layer if present.

Talus. Rock fragments of any size or shape, commonly coarse and angular, derived from and lying at the base of a cliff or very steep, rock slope. The accumulated mass of such loose, broken rock formed chiefly by falling, rolling, or sliding.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay, and clay. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse", "fine", or "very fine".

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Tuff. A compacted deposit that is 50 percent or more volcanic ash and dust.

Upland (geology). Land at higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Vesicular crust. A dense, structureless, and highly porous surface soil layer from 1 to 3 inches thick, normally light in color and usually associated with arid or semiarid rangelands.

Water table. The upper limit of the soil or underlying rock material that is wholly saturated with water.

Water table, apparent. A thick zone of free water in the soil. An apparent water table is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

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(1) mail: U.S. Department of Agriculture
Office of the Assistant Secretary for Civil Rights
1400 Independence Avenue, SW
Washington, D.C. 20250-9410;

(2) fax: (202) 690-7442; or

(3) email: program.intake@usda.gov.

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