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NATIONAL SOIL TAXONOMY HANDBOOK
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Purpose. To distribute current amendments to Soil Taxonomy, Agriculture Handbook 436.

Effective Date. These amendments and revisions are effective when received.

Filing Instructions. File this copy of the changes in the 3-ring binder with Issues Nos. 1 through 17. It is suggested that you keep this binder with the Soil Taxonomy volume for easy reference.

Remove pages iii through x and replace with iii through xiv dated March 1996. File pages 615-663 to 615-731 following page 615-662.

Supplementation. States may not supplement the handbook.

Richard L. Duesterhaus

RICHARD L. DUESTERHAUS
Deputy Chief

Attachments

DIST: NSTH

Section

615.89 Wet soils amendment
615.90 Vertisol amendment
615.91 Spodosol amendment
615.92 Diagnostic horizons
615.93 Definition of the mollic epipedon
615.94 Definition of the histic epipedon
615.95 Table 7, additions and deletions
615.96 Key to Ultisols
615.97 Subgroups of Andisols
615.98 Names of subgroups of Aridisols
615.99 Subgroups of Ustifluvents and Ustorthents
615.100 Folists
615.101 Subgroups of Ustochrepts
615.102 Arenic subgroup of Argiborolls
615.103 Udic subgroup of Calciborolls
615.104 Pachic subgroup of Argiudolls
615.105 Cumulic subgroups of Mollisols
615.106 Lithic Ruptic-Entic Haplustolls
615.107 Ultic subgroups of Xerolls
615.108 Udic subgroups of ustic suborders
615.109 Aeric Albaquults
615.110 Key to Palexerults
615.111 Definitions of *Fragmental, Pumiceous,* and *Cindery*
615.112 Strongly contrasting particle-size classes
615.113 Sloping families
615.114 Corrections and clarification
615.115 Aridisol Amendment
615.116 Subgroups of Durixerolls
615.117 Definition of particle-size classes
615.118 The criteria for Vitrandic subgroups
615.119 Addition of Vitrandic subgroups
615.120 Strongly Contrasting Particle-size Classes
615.121 Humaqueptic and Mollic subgroups of Aquents and Aquepts
615.122 Subgroups of Psamments
615.123 Fibric, Hemic, and Sapric subgroups of Histosols
615.124 Redoximorphic Concentrations
615.125 Udollic Endoaqualfs
615.126 Addition of combination Vertic subgroups in the orders of Alfisols and Mollisols.
615.127 Ultic subgroups of Andisols
615.128 Revisions to Entic and Torriorthentic subgroups of Mollisols
615.129 Aquic Cumulic subgroups of Mollisols
615.130 Xeric Duraquerts
615.131 Lithic Endoaquods
615.132 Entic and Aquentic subgroups of Fragiorthods and Haplorthods
615.133 Key to the Orders and suborders of Histosols
615.134 Family differentiae for Histosols
615.135 Addition of Typic Subgroups
615.136 Table 7, additions and deletions
615.137 Corrections and clarifications

Section

615.138 Definition of Buried Soils
615.139 Definition of Ortstein
615.140 Paralithic and densic materials and contacts and pararock fragments
615.141 Identification of the Taxonomic Class of a Soil.
615.142 Particle-size class and texture.
615.143 Arenic and Grossarenic subgroups
615.144 Changes to Aqualfs and Aeric subgroups of Aqualfs
615.145 Changing "Ustic" Boralfs to Ustalfs and adding new subgroups
615.146 Revised criteria for Palexeralfs
615.147 "Fulvi" great groups of Andisols
615.148 Rhodic great groups and subgroups
615.149 Vertic and combination "Vertic" subgroups of Fluvents
615.150 Aridic Lithic and Gypsic subgroups of Ustochrepts
615.151 Combination "Oxyaquic" Subgroups
615.152 Vermic Great Groups and Subgroups
615.153 Thapto-Histic Hydraquents
615.154 "Vitrandic" subgroups of Ustorthents
615.155 Aquic Calciborolls
615.156 Definition of Lamella and Lamellic, Ochreptic, and Psammentic subgroups
615.157 Combination "Vertic" Subgroups of Borolls and Udolls
615.158 Changes to Natraquerts
615.159 Family Amendment
615.160 Fragipan Amendment
615.161 Udic subgroups of Borolls
615.162 Corrections and Clarifications

Index to pages of Soil Taxonomy

Section	Page
615.01	386
615.02	92, 96, 156, 157, 179, 180, 228, 229, 272, 376, 377, 381
615.03	110, 111
615.04	147, 148, 149, 151, 153
615.05	92, 93, 96, 155, 156, 167, 168, 19, 180, 183, 227, 228, 229, 236, 258 262, 271, 272
615.06	116
615.07	114, 115, 274, 275
615.08	14, 16, 18, 30, 31, 32, 33, 34, 45,46, 48, 49, 50, 62, 64, 68
615.09	92
615.10	95, 96, 109, 125, 130, 132, 134, 135, 138, 139, 142, 147, 151
615.11	160
615.12	179, 181, 183, 206
615.13	222
615.14	228, 229, 230, 236, 239, 240, 241, 247, 248, 267
615.15	271, 272, 286, 288, 294, 295, 296, 298, 299, 300, 306, 307, 308, 310, 316
615.16	324, 327
615.17	337
615.18	350, 360
615.19	383, 384, 385, 388
615.20	513, 615
615.21	385
615.22	183, 194
615.23	289, 297
615.24	353
615.25	251, 254, 256, 260, 263, 300, 303, 316

Section	Page
615.26	298, 303
615.27	251, 252, 254, 255, 256, 257, 260, 261, 263, 264, 300, 301, 303, 304, 305, 316, 317
615.28	104
615.29	297
615.30	4, 15-17, 23, 25, 26, 29-33, 36, 42-46, 51, 73, 109-119, 122-126, 128, 129, 133, 136-139, 141, 142, 146, 148-152, 160, 162, 167, 172, 182, 183, 185, 186, 188, 189, 191-193, 195, 196, 203, 204, 206, 208, 212, 216, 230, 231, 233, 234, 237, 238, 240-244, 246, 247, 248, 249, 253, 254-257, 262-268, 273, 274, 277-282, 284-288, 290, 292, 293, 295-299, 301, 306-308, 311, 319, 320, 334-336, 338, 344, 349-354, 357, 361, 363, 372, 376, 379, 391
615.31	195
615.32	202, 203, 205-208, 267
615.33	302
615.34	337
615.35	365, 366
615.36	18
615.37	32, 123, 139, 162, 172, 182, 193, 216, 230, 249, 254, 277, 279, 284, 293, 334, 391
615.38	27, 86-89, 92, 93, 95, 96, 109, 110, 112-115, 117, 118, 125, 126, 128, 129, 133, 134, 136-148, 150, 151, 153, 156, 180, 227-229, 259, 262, 263, 271, 296, 304, 323, 336-347, 349-358, 360-362, 364, 366, 367, 369-371, 385
615.39	361
615.40	204
615.41	134
615.42	229
615.43	109, 125, 137, 139-146, 254, 255, 273, 295, 298-304, 306, 308, 309
615.44	52, 194, 196, 198-201, 228, 229, 256, 282, 283, 351, 385, 420, 427
615.45	36, 38-39, 41, 48, 56, 87-88, 90, 92, 96, 100
615.46	121-122
615.47	128
615.48	1, 36, 302

Section	Page
615.49	116
615.50	119
615.51	141, 142
615.52	147, 148
615.53	149, 150
615.54	180, 187
615.55	192, 193
615.56	356, 357, 358
615.57	373
615.58	385
615.59	179, 227, 229, 349
615.60	13-14, 17, 36, 47, 49, 63-65, 69, 71-73, 75, 77, 79-81, 84, 86-93, 96, 104-105, 107, 154, 156-157, 179-180, 212, 227-238, 241, 243, 245, 247, 257, 258, 264, 271-272, 323, 333, 340, 349-350, 384-386
615.61	New (no pages given)
615.62	91, 110, 112-116, 118-130, 133-134, 139, 141-143, 146-153, 157-160, 162-164, 166, 168-169, 171-172, 174, 175-177, 182-189, 191-193, 195-208, 213-226, 238-246, 248-256, 258-263, 265-268, 274, 276-283, 285-286, 288-289, 291-304, 306, 308-317, 319-321, (NSTH pages 615-125 to 127, 615-129, 615-131, 615-133, 615-136 to 138, 615-141, 615-142, 615-144, 615-146, 615-147, 615-150, 615-152, 615-154, 615-156), 335-339, 341-346, 352 (NSTH page 615-78), 353-357 (NSTH pages 615-82 to 84), 358 (NSTH pages 615-171 to 172), 362-363, 364 (NSTH pages 615-87 to 90), 367, 370-371 (NSTH pages 615-93 to 97), 372-373
615.63	27 (NSTH page 615-52), 36, 258, 260, 262, 323, 385
615.64	75, 92, 95, 96, 206, 207, 337 (NSTH pages 615-357 to 358), 339 (NSTH page 615-358), 344 (NSTH page 615-363), 346 (NSTH page 615-364), 347, 349, 350, 360, 362, 372
615.65	33, 44, 78, 92, 95, 96, 109, 110, 112, 113, 114 (NSTH page 615-212), 115, 118, 119, 120, 120 (NSTH page 615-216), 121, 121 (NSTH page 615-217), 122, 123, 123 (NSTH 615-219), 124, 125, 126, 127, 128, 128 (NSTH 615-161), 127 (NSTH pages 615-220, 221), 129, 129 (NSTH 615-221), 130, 131, 133, 133 (NSTH pages 615-62, 63, 226), 150, 164, 165, 283 (NSTH page 615-319), 284, 291, 291 (NSTH pages 615-325, 326), 306 (NSTH page 615-341), 307, 345, 349, 350

Section	Page
615.66	No page number (NSTH page 615-1), 237 (NSTH page 615-204), No page number (NSTH page 615-219), 127 (NSTH page 615-220), 130 (NSTH page 615-223), 141 (NSTH page 615-231), No page number (NSTH page 615-238), 296 (NSTH page 615-328), 339 (NSTH page 615-359), 344 (NSTH page 615-363), No page number (NSTH page 615-376), 258 (NSTH page 615-388)
615.67	As applicable throughout *Soil Taxonomy*
615.68	27 (NSTH page 615-52), 36 (NSTH page 615-112), No page number (NSTH page 615-118), 41, 384, 387
615.69	34, 36
615.70	13, 49, 65
615.71	129, 138, 145
615.72	87, 202 (NSTH page 615-277), 203, 204, (NSTH page 615-278), 206 (NSTH page 615-279), 207 (NSTH page 615-280), 208 (NSTH 615-280)
615.73	204 (NSTH page 615-278), 229
615.74	273
615.75	283 (NSTH page 615-317)
615.76	283 (NSTH page 615-319), 286 (615-320), 286 (NSTH page 615-321), 287 (NSTH page 615-322), 300 (NSTH page 615-333), 311 (NSTH page 615-344), 311 (NSTH page 615-345)
615.77	87, 343, 347
615.78	385
615.79	385 (NSTH page 615-207)
615.80	391
615.81	No page number (NSTH page 615-52), no page number (NSTH page 615-55)
615.82	157, 158 (NSTH page 615-241), 158 (NSTH page 615-243), 159, 165, 166, (NSTH page 615-252)
615.83	351
615.84	388
615.85	295, 296 (NSTH pages 615-328 to 615-331), 298 (NSTH page 615-331)
615.86	388
615.87	158 (NSTH pages 615-241 to 242), 159 (NSTH pages 615-243 to 246),162 (NSTH page 615-247), 163 (NSTH pages 615-248 to 249), 166 (NSTH pages 615-250 to 252), 168 (NSTH pages 615-252 to 253), 171 (NSTH pages 615-254 to 257), 174 (NSTH

Section	Page
615.110	372-373
615.111	50, 383, 384, no page number (NSTH page 615-206)
615.112	385 (NSTH page 615-207)
615.113	383, 388, 389
615.114	No page numbers
615.115	41, 45, 46, 47, 51, 85, 88, 95, 96, 109, 137, 139, 140, 142, 143, 144, 145, 146, 155, 180, 190, 194, 197, 201, 205, 209, 227, 228, 257, 285, 298, 301, 302, 304, 305, 308, 309, 312, 315, 318, 321, 384
615.116	315 (NSTH 615.62 p. 615-347) (changed NSTH 615.90 P. 615-545)
615.117	384 (NSTH 615.68, p. 615-396)
615.118	No page number (NSTH 615.62, p. 615-209) (615.90, p. 615-516)., (NSTH 615.89, p. 615-428), (NSTH 615.89, p. 615-429), (NSTH 615.62, p. 615-215), (NSTH 615.62, p. 615-215), (615.90, p. 615-516), (NSTH 615.62, p. 615-216), (615.90, p. 615-516), (NSTH 615.62, p. 615-218), (NSTH 615.62, p. 615-218), (NSTH 615.62, p. 615-219) (NSTH 615.89, p. 615-438), (NSTH 615.89, p. 615-438), (NSTH 615.62, p. 615-222), (NSTH 615.89, p. 615-439), (NSTH 615.62, p. 615-236), (NSTH 615.89, p. 615-446), (NSTH 615.62, p. 615-237), (NSTH 615.89, p. 615-446), (NSTH 615.89, p. 615-447), (NSTH 615.62, p. 615-239), (NSTH 615.89, p. 615-447), (NSTH 615.62, p. 615-262), (NSTH 615.62, p. 615-263), (NSTH 615.89, p. 615-461), (NSTH 615.62, p. 615-267), (NSTH 615.62, p. 615-268), (NSTH 615.62, p. 615-268), (NSTH 615.62, p. 615-269), (NSTH 615.89, p. 615-467), (NSTH 615.89, p. 615-467), (NSTH 615.62, p. 615-271), (NSTH 615.62, p. 615-273), (NSTH 615.62, p. 615-274), (NSTH 615.62, p. 615-275), (NSTH 615.89, p. 615-469), (NSTH 615.62, p. 615-276), (NSTH 615.62, p. 615-290), (NSTH 615.89, p. 615-475), (NSTH 615.89, p. 615-476), (NSTH 615.62, p. 615-291), (NSTH 615.62, p. 615-294), (NSTH 615.62, p. 615-294), (NSTH 615.62, p. 615-295), (NSTH 615.62, p. 615-296), (NSTH 615.89, p. 615-480), (NSTH 615.89, p. 615-480), (NSTH 615.89, p. 615-480), (NSTH 615.89, p. 615-481), (NSTH 615.62, p. 615-298), (NSTH 615.89, p. 615-481), (NSTH 615.62, p. 615-300), (NSTH 615.89, p. 615-482), (NSTH 615.62, p. 615-301), (NSTH 615.89, p. 615-479), (NSTH 615.62, p. 615-302), (NSTH 615.89, p. 615-483), (NSTH 615.89, p. 615-483), (NSTH 615.62, p. 615-304), (NSTH 615.62, p. 615-306), (NSTH 615.62, p. 615-307), (NSTH 615.89, p. 615-484), (NSTH 615.62, p. 615-308), (NSTH 615.62, p. 615-310), (NSTH 615.62, p. 615-311), (NSTH 615.62, p. 615-311), (NSTH 615.62, p. 615-313), (NSTH 615.62, p. 615-314), (NSTH 615.90, p. 615-532), (NSTH 615.62, p. 615-315), (NSTH 615.90, p. 615-533), (NSTH 615.89, p. 615-489), (NSTH 615.89, p. 615-490), (NSTH 615.62, p. 615-318), (NSTH 615.90, p. 615-534), (NSTH 615.62, p. 615-321),

Section	Page
	pages 615-259 to 260), 176 (NSTH page 615-261), 177 (NSTH page 615-262)
615.88	86, 87, 92, 364, 373 (NSTH page 615-383), 384 (NSTH page 615-366)
615.89	34, 36 (NSTH page 615-387), 42, 47, 48,50-51, 54, 55, 63, 77, 79, 83, 85, 89,90, 93, 95, 96-373 (NSTH pages 615-179/384)
615.90	48, 51, 75, 76, 92 (NSTH page 615-179), 95-96 (NSTH page 615-179), 110-382 (NSTH pages 615-209/386)
615.91	29-32, 63, 92, 96 NSTH page 615-179), no page number (NSTH pages 615-186, 188, 200, 203), 155, 156 (NSTH page 615-203), 179, 180 (NSTH page 615-204), 186 (NSTH page 615-266), 202 (NSTH page 615-277), 203, 204 (NSTH page 615-277/278), 206 (NSTH page 615-279), 207, 212 NSTH page 615-204), 227, 228-229 (NSTH page 204), 271 (NSTH page 615-204), 272 (NSTH pages 615-13 & 204), 323 (NSTH page 615-123, 333-347, 349 (NSTH pages 615-205 & 389), 364 (NSTH 615-376), 366, 384
615.92	14 (NSTH page 615-15)
615.93	15
615.94	17-18
615.95	86-87
615.96	92
615.97	No page number (NSTH pages 615-188 to 203)
615.98	158 (NSTH page 615-242), 171 (NSTH page 615-257), 174 (NSTH page 615-259)
615.99	192 (NSTH page 615-270), 200 (NSTH page 615-276)
615.100	218, 219
615.101	254 (NSTH pages 615-302/303)
615.102	282 (NSTH pages 615-317 & 319)
615.103	285 (NSTH page 615-320)
615.104	296 (NSTH page 615-328)
615.105	286 (NSTH page 615-321), 287, 288 (NSTH page 615-323), 303 (NSTH page 615-338), 316 (NSTH page 615-348), 318
615.106	304 (NSTH page 615-336), 305
615.107	311 (NSTH pages 615-343 to 345), 313, 316 (NSTH pages 615-348 to 350), 317-318
615.108	No page numbers (NSTH pages 615-228 to 383)
615.109	352 (NSTH page 615-365)

Section	Page
615.136	86
615.137	96, 109, 218, and 251, (NSTH 615.45 p 615-123), (NSTH 615.60 p. 615-176, 615-185, 615-186, 615-192, 615-187, 615-195, 615-196, 615-197, 615-199, and 615-206), (NSTH 615.62 p. 615-300), (NSTH 615.89 p. 615-427, 615-449, and 615-508), (NSTH 615.90 p. 615-564), (NSTH 615.91 p. 615-587), (NSTH 615.100 p. 615-597)
615.138	2
615.139	49
615.140	15, 36, 48, 49, 53, 54, 57, 65, 68, 69, 91, 95, 179, 211, 271, 323, 333, 349, 375, NSTH 615.89 p. 615-424, 615.115 p. 615-606, NSTH 615.115 p. 615-607, NSTH 615.115 p. 615-609,
615.141	91, NSTH 615.115, p. 615-609, NSTH 615.115, p. 615-611
615.142	95, 96, 299, 307, 311, 320, NSTH 615.62, p. 615-305, NSTH 615.79, p. 615-402, NSTH 615.62, p. 615-323, NSTH 615.62, p. 615-324, NSTH 615.129, p., 615-655, NSTH 615.62, p., 615-325, NSTH 615.62, p. 615-342, NSTH 615.62, p. 615-343, NSTH 615.62, p. 615-344, NSTH 615.62, p. 615-345, NSTH 615.62, p. 615-349, NSTH 615.62, p. 615-350, NSTH 615.62, p. 615-352, NSTH 615.91, p. 615-572, NSTH 615.45, p. 615-112, NSTH 615.45, p. 615-122, NSTH 615.45, p. 615-115, NSTH 615.45, p. 615-117, NSTH 615.45, p. 615-118, NSTH 615.91, p. 615-577,
615.143	NSTH 615.62, p. 615-209, NSTH 615.89, p. 615-428, NSTH 615.89, p. 615-430, NSTH 615.62, p. 615-210, NSTH 615.62, p. 615-211, NSTH 615.62, p. 615-215, NSTH 615.62, p. 615-216 and 217, NSTH 615.62, p. 615-221, NSTH 615.62, p. 615-222 and 223, NSTH 615.62, p. 615-225, NSTH 615.62, p. 615-227, NSTH 615.62, p. 615-228 and 229, NSTH 615.62, p. 615-230, NSTH 615.62, p. 615-232, NSTH 615.62, p. 615-233 and 234, NSTH 615.62, p. 615-240, NSTH 615.115, p 615-612, NSTH 615.115, p 615-615, NSTH 615.115, p 615-618, NSTH 615.62, p. 615-300, NSTH 615.62, p. 615-314, NSTH 615.102, p. 615-600, NSTH 615.91, p. 615-579, NSTH 615.91, p. 615-587 and 588, NSTH 615.89, p. 615-507, NSTH 615.89, p. 615-508, NSTH 615.62, p. 615-366, NSTH 615.62, p. 615-367, NSTH 615.62, p. 615-371, NSTH 615.62, p. 615-372, NSTH 615.62, p. 615-373 and 374, NSTH 615.62, p. 615-375, NSTH 615.62, p. 615-377, NSTH 615.62, p. 615-379, NSTH 615.62, p. 615-380, NSTH 615.62, p. 615-381, NSTH 615.62, p. 615-383,
615.144	96, NSTH 615.89 p. 615-427, NSTH 615.62, p. 615-211, NSTH 615.125, p. 615-649, NSTH 615.89, p. 615-428, NSTH 615.126, p. 615-650, NSTH 615.89, p. 615-430
615.145	109, 139, 141, 143, NSTH 615.62, p. 615-216 and 615-217, NSTH 615.62, p. 615-228, NSTH 615.62, p. 615-229, NSTH 615.62, p. 615-230, NSTH 615.62, p. 615-232, NSTH 615.90, p. 615-519, NSTH 615.62, p. 615-233; NSTH 615.62, p. 615-234
615.146	147, 151

Section	Page
	(NSTH 615.62, p. 615-323), (NSTH 615.62, p. 615-328), (NSTH 615.90 p. 615-537), (NSTH 615.62, p. 615-329), (NSTH 615.90, p. 615-538), (NSTH 615.62, p. 615-332), (NSTH 615.62, p. 615-332), (NSTH 615.62, p. 615-338), (NSTH 615.106, p. 615-601), (NSTH 615.62, p. 615-344), (NSTH 615.90, p. 615-544), (NSTH 615.62, p. 615-344), (NSTH 615.62, p. 615-346), (NSTH 615.90, p. 615-545), (NSTH 615.62, p. 615-347), (NSTH 615.62, p. 615 348), (NSTH 615.62, p. 615-348)
615.119	202, (NSTH 615.62 p. 615-277), 205, (NSTH 615.62 p. 615-278), 208, (NSTH 615.62 p. 615-280 and 615-281), 314, (NSTH 615.62 p. 615-346)
615.120	386, (NSTH 615.60, p. 615-207) (revised NSTH 615.112 p. 615-605)
615.121	183 and 186, (NSTH 615.89 p. 615-462, 615-463, 615-464, 615-476 615-477 and 615-478), and (NSTH 615.62 p. 615-264, 615-265, and 615-266)
615.122	202, 204, 206, 207, and 208, (NSTH 615.62 p. 615-277,615-278, 615-279, and 615-280), (NSTH 615.72 p. 615-397 and 615-398)
615.123	218, 215, 216, 217, 220, 221, 222, 223, 224, 225, and 226, (NSTH 615.62 p. 615-281, 615-282, 615-283, 615-284, 615-285, 615-286, 615-287, 615-288, and 615-289)
615.124	48, (NSTH 615.89 p. 615-425)
615.125	No page number, (NSTH 615.89 p. 615-429)
615.126	110, 130, 139, 143, 283, (NSTH 615.61 p. 615-209, 615-222), (NSTH 615.90 p. 615-517, 615-518, 615-519, 615-535, 615-537) (NSTH 615.89 po. 615-489 and 615-490)
615.127	No page number (NSTH 615.60 p. 615-188, 615-199, and 615-203)
615.128	297, 304, 316, 317, (NSTH 615.62 p. 615-330, 615-339, 615-340, 615-350)
615.129	286, 288, 289, 296, 297, 304, 316, and 317, (NSTH 615.62 p. 615-321, 615-323, 615-329, 615-338, 615-329)
615.130	No page number, (NSTH 615.90 p. 615-551)
615.131	No page number, (NSTH 615.91 p. 615-581)
615.132	No page number, (NSTH 615.91 p 615-589 and 615-590)
615.133	92, and 21-2, (NSTH 615.91 p. 615-573)
615.134	390
615.135	111, 117, 124, 125, 136, 138, 145, 153, 214, 221, 245, 257, 262, 358, 358, 366, 371, 373,

Section	Page
615.147	NSTH 615.60 p. 615-185, NSTH 615.60, p. 615-190
615.148	125, 134, 136, 138, 143, 145, 147, 153, 360, 364, 365, 369, NSTH 615.62, p. 615-225, NSTH 615.62, p. 615-226, NSTH 615.62 p. 615-227, NSTH 615.62, p. 615-228, NSTH 615.62, p. 615-231, NSTH 615.62, p. 615-232, NSTH 615.62, p. 615-234, NSTH 615.62, p. 615-235, NSTH 615.45, p. 615-129, NSTH 615.62, p. 615-353, NSTH 615.45, p, 615-131, NSTH 615.45, p. 615-129, NSTH 615.62, p. 615-353, NSTH 615.45, p. 615-133, NSTH 615.62, p. 615-352, NSTH 615.45, p. 615-135, NSTH 615.62, p. 615-354, NSTH 615.45, p, 615-140, NSTH 615.45, p. 615-142, NSTH 615.45, p. 615-144, NSTH 615.62, p. 615-355, NSTH 615.45, p. 615-146, NSTH 615.62, p. 615-355, NSTH 615.45, p. 615-149, NSTH 615.62, p. 615-356, NSTH 615.45, p. 615-151, NSTH 615.45, p. 615-152, NSTH 615.45, p. 615-153, NSTH 615.45, p. 615-154, NSTH 615.45, p. 615-155, NSTH 615.62, p. 615-373, NSTH 615.62, p. 615-375, NSTH 615.62, p. 615-376, NSTH 615.62, p. 615-377, NSTH 615.62, p. 615-378, NSTH 615.62, p. 615-381, NSTH 615.62, p. 615-382
615.149	192, NSTH 615.62, p. 615-269, NSTH 615.89, p. 615-466, NSTH 615.62, p. 615-270
615.150	225, NSTH 615.62 p. 615-302, NSTH 615.62, p. 615-303
615.151	NSTH 615.62, p. 615-216, NSTH 615.60, p. 615-188, NSTH 615.91, p. 615-589, NSTH 615.91, p. 615-590
615.152	109, 119, 114, 236, 239, 246, NSTH 615.62, p. 615-212, NSTH 615.90, p. 615-516, NSTH 615.62, p. 615-210
615.153	185, NSTH 615.62, p. 615-266
615.154	200, NSTH 615.62, p. 615-276, NSTH 615-89 p. 615-469, NSTH 615.99 p. 615-596, NSTH 615.62, p. 615-276
615.155	NSTH 615.89, p. 615-491, NSTH 615.89, p. 615-492
615.156	27, 36, 48, 180, 181, NSTH 615.62, p. 615-216, NSTH 615.62, p. 615-217, NSTH 615.62, p. 615-219, NSTH 615.62, p. 615-222, NSTH 615.62, p. 615-224, NSTH 615.62, p. 615-227, NSTH 615.62, p. 615-228, NSTH 615.62, p. 615-229, NSTH 615.62, p. 615-230, NSTH 615.62, p. 615-233, NSTH 615.89, p. 615-445, NSTH 615.62, p. 615-235, NSTH 615.62, p. 615-238, NSTH 615.62, p. 615-239, NSTH 615.62, p. 615-240, NSTH 615.62, p. 615-272, NSTH 615.62, p. 615-297, NSTH 615.62, p. 615-298 and 615-299, NSTH 615.89, p. 615-482, NSTH 615.62, p. 615-300, NSTH 615.62, p. 615-301, NSTH 615.89, p. 615-483, NSTH 615.62, p. 615-302 and 615-303, NSTH 615.62, p. 615-304 and 615-305, NSTH 615.62, p. 615-312, NSTH 615.89, p. 615-486, NSTH 615.62, p. 615-328, NSTH 615.85, p. 615-405, NSTH 615.89, p. 615-494, NSTH 615.62, p. 615-329, NSTH 615.91, p. 615-590, NSTH 615.91, p. 615-591, NSTH 615.62, p. 615-372, NSTH 615.62, p. 615-373, NSTH 615.62, p. 615-376, NSTH 615.62, p. 615-377 and 378, NSTH 615.89, p. 615-513, NSTH 615.62, p. 615-379, NSTH 615.62, p. 615-383, NSTH 615.62, p. 615-384

Section	Page
615.157	NSTH 615.62, p. 615-317, NSTH 615.90 p. 615-537, NSTH 615.102 p. 615-600, NSTH 615.127 p. 615-653, NSTH 615.62, p. 615-318, NSTH 615.62, p. 615-323 and 324, NSTH 615.62, p. 615-325, NSTH 615.62, p. 615-328, NSTH 615.89, p. 615-493, NSTH 615.104 p. 615-600, NSTH 615.89, p. 615-492, NSTH 615.130 p. 615-655
615.158	NSTH 615.90, p. 615-550, NSTH 615.90, p. 615-551, NSTH 615.90, p. 615-552, NSTH 615.90, p. 615-553, NSTH 615.90, p. 615-555, NSTH 615.115, p. 615-607 column 1, delete entire section on families and replace with the following:
615.159	49, 80, 84, 88, 383
615.160	42, 49, 109, 112, 119, 122, 125, 126, 134, 151, 236, 238, 239, 243, 351, 352, 353, 355, 360, 361, 362, 364, 367, NSTH 615.62, p. 615-211, NSTH 615.38 p. 615-59, NSTH 615.38 p. 615-62, NSTH 615.38 p. 615-63, NSTH 615.89 p. 615-428, NSTH 615.89 p. 615-429, NSTH 615.62, p 615-217, NSTH 615.89, p 615-435, NSTH 615.62, p 615-218, NSTH 615.47; p 615-161, NSTH 615.62, p 615-221, NSTH 615.62, p 615-222, NSTH 615.89, p 615-440, NSTH 615.62, p 615-224, NSTH 615.62, p 615-226, NSTH 615.89, p 615-442, NSTH 615.62, p 615-228, NSTH 615.04, p. 615-6, NSTH 615.04, p. 615-8, NSTH 615.62, p 615-238, NSTH 615.62, p 615-239, NSTH 615.62, p 615-240, NSTH 615.89 p. 615-475 NSTH 615.89, p. 615-476, NSTH 615.89 p. 615-477, NSTH 615.89, p. 615-478, NSTH 615.122, p. 615-646, NSTH 615.62, p 615-298, NSTH 615.89, p 615-481, NSTH 615.62, p. 615-299, NSTH 615.62, p 615-300, NSTH 615.89, p 615-482, NSTH 615.62, p 615-304, NSTH 615.62, p. 615-305, NSTH 615.91, p. 615-578, NSTH 615.91, p. 615-580, NSTH 615.91, p. 615-581, NSTH 615.91, p. 615-582, NSTH 615.91, p. 615-585, NSTH 615.91, p. 615-586, NSTH 615.91, p. 615-587, NSTH 615.91, p. 615-588, NSTH 615.91, p. 615-589, NSTH 615.91, p 615-590, NSTH 615.38 p. 615-78, NSTH 615.38 p. 615-79, NSTH 615.38 p. 615-85, NSTH 615.38 p. 615-87, NSTH 615.38 p. 615-89, NSTH 615.62, p 615-372, NSTH 615.62, p 615-375, NSTH 615.62, p. 615-373, NSTH 615.62, p 615-375, NSTH 615.62, p. 615-376, NSTH 615.90, p 615-548, NSTH 615.62, p 615-378, NSTH 615.62, p. 615-379, column 1 and NSTH 615.38 p. 615-91
615.161	282, NSTH 615.62, p. 615-317, NSTH 615.62, p. 615-318, NSTH 615.62, p. 615-319, NSTH 615.62, p. 615-323, NSTH 615.62, p. 615-324, NSTH 615.62, p. 615-325, NSTH 615.62, p. 615-326, NSTH 615.62, p. 615-327
615.162	28, 48, 54, 125, 309, 352, NSTH 615.89, p. 615-424, NSTH 615.26, p. 615-30, NSTH 615.115, p. 615-624, NSTH 615.62, p. 615-336, NSTH 615.115, p. 615-625

615.138 Definition of Buried Soils

Page 2, column 2. Replace section on buried soils with the following:

"BURIED SOILS

A soil is defined as a buried soil if it is covered with a surface mantle of new soil material that is either 50 cm or more thick, or is 30 to 50 cm thick and has a thickness that equals at least half the total thickness of the named diagnostic horizons that are preserved in the buried soil. A surface mantle of new material less than 30 cm thick is not considered in the taxonomy, except for the soil temperature, soil moisture (including aquic conditions), and any andic or vitrandic properties. The surface mantle is considered in establishing a phase if it affects the use of the soil.

A surface mantle of new material, as defined here, is largely unaltered, at least in the lower part. It may have a diagnostic surface horizon (epipedon) and/or a cambic horizon, but has no other diagnostic subsurface horizons, all defined later. However, there remains a layer 7.5 cm or more thick that fails the requirements for all diagnostic horizons, as defined later, overlying a horizon sequence that can be clearly identified as the solum of a buried soil in at least half of each pedon. This layer must also fail color and structure requirements of the cambic horizon if sandy. The recognition of a surface mantle should not be based only on studies of associated soils."

615.139 Definition of Ortstein

Page 49 column 2, following "Organic soil materials" add the following:

"Ortstein

Ortstein is a cemented horizon that consists of spodic materials.

Ortstein has one of the following orientations:

1. As a relatively horizontal layer. This type of orientation tends to be root restrictive and occurs primarily in Aquods.

2. As vertical to irregular columns, tongues, pillars, or bridges. This orientation tends to be less root restrictive than the horizontal orientation. This type of orientation occurs primarily in Orthods.

3. As nodules. These may be remnants of one of the orientations listed above.

Ortstein is 25 mm or more thick and 50 percent or more (by volume) cemented. Continuous ortstein is 90 percent or more cemented and has lateral continuity such that roots cannot penetrate except along vertical fractures, which have a horizontal spacing of 10 cm or more.

Ortstein is differentiated from a placic horizon that is within spodic materials solely on thickness. Placic horizons within spodic materials are less than 25 mm thick and ortstein is 25 mm or more thick.

Summary of properties

Ortstein has all of the following:

1. Consists of spodic materials; and

2. Is in a layer that is 50 percent or more cemented; and

3. Is 25 mm or more thick."

615.140 Paralithic, and densic materials and contacts and pararock fragments

Page 15, column 2, last line; Rewrite item 5. and 5.a. as follows:

"5. After mixing the upper 18 cm of the mineral soil, or the whole mineral soil if its depth to a densic, lithic, or paralithic contact, a petrocalcic horizon, or a duripan (all defined below) is less than 18 cm, the thickness of the epipedon is as follows:

a. 10 cm or more if the epipedon is directly above a densic, lithic, or paralithic contact, a petrocalcic horizon, or a duripan; or"

NSTH 615.79, before "a lithic,"; Add "a densic" in the following places:

P. 615-402, column 2, line 6; P. 615-402, column 2, line 18; P. 615-403 column 1, line 8; P. 615-403 column 1, line 12

NSTH 615.91, p 615-571, Identification, line 4; Replace "a *lithic* or *paralithic*" with "a densic, lithic, or paralithic"

NSTH 615.91, p 615-572, column 1, line 20; Replace "lithic" with "densic, lithic,"

NSTH 615.91, p 615-572, column 1, line 43, before "petroferric"; Add "densic, "

Page 53, column 2, line 36; Replace entire paragraph with the following:

"If 7.5 cm of water moistens the soil to a densic, lithic, paralithic, or petroferric contact or to a petrocalcic or petrogypsic horizon or a duripan, the contact or the upper boundary of the cemented horizon constitutes the lower boundary of the soil moisture control section. If a soil is moistened to one of these contacts or horizons by 2.5 cm of water, the soil moisture control section is the contact or boundary itself. The control section of such a soil is considered moist if the contact or upper boundary of the cemented horizon has a thin film of water. If that upper boundary is dry, the control section is considered dry."

NSTH 615.79, p. 615-402, column 2, line 18, before "a lithic,"; Add "a densic"

Page 48, before "Durinodes"; Add the following:

"Densic contact
A densic contact (L. *densus*, thick) is a contact between soil and densic materials (defined below) that has no cracks or the spacing of cracks that roots can enter is 10 cm or more. It differs from both the *lithic contact* and the *paralithic contact* in that air dried fragments of the material forming a densic contact slake when submerged in water.

Densic materials
Densic materials are relatively unaltered (do not meet requirements for any other named diagnostic horizons nor any other diagnostic soil characteristic) materials that have a non-cemented rupture resistance class. The bulk density or the organization is such that roots cannot enter except in cracks. These are mostly earthy materials such as till, volcanic mudflows, and some mechanically compacted materials such as mine spoils. Some non-cemented rocks can also be densic materials, if they are dense or resistant enough to prevent roots from entering except in cracks.

Densic materials have at their upper boundary a *densic contact* if the densic material has no cracks or the spacing of cracks that roots can enter is 10 cm or more. Densic materials can be used to differentiate soil series if the materials are within the series control section (defined below)."

Page 49, delete entire section "paralithic contact", and insert the following:

"**Paralithic contact**
A paralithic (lithic like) contact is a contact between soil and paralithic materials (defined below) where the paralithic materials have no cracks or the spacing of cracks that roots can enter is 10 cm or more. It differs from the *densic contact* and the *lithic contact* in that the material forming a densic contact slakes when air dried fragments are submerged in water and the material forming a lithic contact is in a strongly cemented or more cemented rupture resistance class (rock fragments).

Paralithic materials
Paralithic materials are relatively unaltered (do not meet requirements for any other named diagnostic horizons or other diagnostic soil characteristic) materials that have a very weakly cemented to moderately cemented rupture resistance class. Cementation, bulk density, and the organization is such that roots cannot enter except in cracks. Paralithic materials have at their upper boundary a *paralithic contact* if the paralithic materials have no cracks or if the spacing of cracks that roots can enter is 10 cm or more. Commonly these materials are partially weathered bedrock or weakly consolidated bedrock such as sandstone, siltstone, or shale. Paralithic materials can be used to differentiate soil series if the materials are within the series control section (defined below). Fragments of paralithic materials, 2.0 mm or more in diameter, are referred to as pararock fragments."

Page 36, column 1, line 43, item c. [changed to (2) in NSTH 615.89 p. 615-424], Change "If all coarse fragments in the k horizon" to "If all rock and pararock fragments in the Bk horizon"

NSTH 615.115 p. 615-606 column 2, line 25 change "rock fragments." to "rock and pararock fragments."

NSTH 615.115 p. 615-607 column 1, item 2. change "rock fragments;" to "rock and pararock fragments;"

NSTH 615.115 p. 615-607 column 1, line 58 change "rock fragments." to "rock and pararock fragments."

NSTH 615.115 p. 615-609 column 1, line 32 change "rock fragments." to "rock and pararock fragments."

Page 54, column 2, line 7, change "coarse fragments." to "rock and pararock fragments

Page 57, column 1, line 27; Replace "lithic" with "densic, lithic,"

Page 62, column 2, line 42; Replace "lithic" with "densic, lithic,"

Page 63, Replace "lithic" with "densic, lithic," in the following places: column 1, line 21; column 1, line 27; column 1, line 33; column 2, line 5; column 2, line 10;

Page 65, Replace "lithic" with "densic, lithic," in the following places: column 2, line 3; column 2, line 9;

Page 68, Replace "lithic" with "densic, lithic," in the following places: column 2, line 38; column 2, line 48;

Page 69, Replace "lithic" with "densic, lithic," in the following places: column 1, line 17; column 2, line 2;

Page 91, Replace "lithic" with "densic, lithic," in the following places:
Item A.1.; Item A.2.a.; Item A.2.c.; Item B.3.c.(1); Item B.3.d.(2)(a); Item B.3.d.(2)(b); Item C.1.; C.2.; E.2.; G.1.a.(2); G.1.b.(3); G.2.b.(3); H.2.

Page 95, Chapter 8 Alfisols; Replace "lithic" with "densic, lithic," in the following places:
Definition (of Alfisols) items; 1.a.(2), (2 places); 1.b.; 3.c.; 4.b.; 7.; Limits between Alfisols and other orders items; 1.; 5.b.; 8.b.(1)(c); 8.b.(2)(c); 8.b.(3)(b); 9.b.; All vertic and vertic combination subgroups; All ultic and ultic combination subgroups; All definitions of typic subgroups (exclusion of ultic, vertic, and combination subgroups; Item IEG.1.; Item IEI.1.; Definition of Hapludalfs item 4.; Descriptions of ultic, psammentic, and combination subgroups; Definition of Kandiudalfs item 2.; (Vertic Paleudalfs and definition of typic subgroup, delete "lithic" and "paralithic" reference.); Item ICD.2.; Item ICF.2.; Item ICF.3.; Definition of Haplustalfs, items 6. and 7.; Definition of Kandiustalfs, item 2.; Definition of Paleustalfs items 3.b., 3.c., and last paragraph; Definition of Rhodustalfs, items 4. and 5.; Item IDF. 2. and 3.; Definition of Haploxeralfs, items 4. Definition of Palexeralfs, items 1.b. and 1.c. and in last paragraph;

NSTH 615.60, p. 615-179, Chapter 9 Andisols; Replace "lithic" with "densic, lithic," in the following places:
Key to suborders, items CD.2., CE.1., CE.2.; Definition of Aquands item 2.; Items CAD.1. and CAD.2.; Definition of Vitraquands items 1.a. and 1.b.; Items CBD.1., CBD.2., CBE.1., and CAE.2.; Definition of Hydrocryands items 3.a. and 3.b.; Definition of Vitricryands items 3.a. and 3.b.; Items CGE.1. and CGE.2.; Definition of Hydrudands items 4.a. and 4.b.; Definition of Vitrands items 4.a. and 4.b.; Items CDA.1. and CDA.2.; Definition of Vitrixerands items 1. and 2.

NSTH 615.115, p. 615-610, Chapter 10 Aridisols; Replace "lithic" with "densic, lithic," in the following places:
Definition of Aridisols items 4. and 6.b.; Item FAC.; Definition of Calciargids item 4.; All vertic, fluventic and combination subgroups; All descriptions of typic subgroups of great groups that have vertic and/or fluventic subgroups; Definition of Gypsiargids item 4.; Definition of Haplargids item 3.; Definition of Paleargids item 1.

Page 179, Chapter 11 Entisols; Replace "lithic" with "densic, lithic," in the following places:
Definition of Entisols items 3.b. and 4.; Limits between Entisols and other orders, items; 2. and 10.b.; Items KA.3., KC., KD., and KD.2; Definition of Aquents items 3.; Items KAD. and KAE.; Definition of Endoaquents items 4.a. (2 times) and 5.; Definition of Epiaquents items 4.a. (2 times) and 5.; All tropic, vermic, vertic and combination subgroups; All definitions of typic subgroups of great groups that have tropic, vermic, and/or vertic subgroups; Definition of Hydraquents item 3.; Definition of Psammaquents item 2.; Definition of Fluvaquents items 1. and 7.; Definition of Orthents items 1. (2 places), 2., and 3.; Definition of Psamments items 1.

Page 211, Chapter 12 Histosols; Replace "lithic" with "densic, lithic," in the following places:

Definition of Histosols items 1.a., 1.b., and 3.; Items AA.1. and AB.2.; Definition of Fibrists items 1.a. and 2.; Item ABA.; Definition of Borofibrists item 3.; Definition of Cryofibrists item 2.; Definition of Medifibrists items 1. and 2.; Page 216, column 1, line 2; Definition of Sphagnofibrists item 1.; Definition of Tropofibrists items 1. and 2.; Definition of Folists items 1.a. and 2.; Definition of Hemists item 1.; Definition of Medihemists item 1.; Definition of Tropohemists item 1.; Definition of Saprists item 1.; Definition of Medisaprists item 1.; Definition of Troposaprists item 1.

Page 227, Chapter 13 Inceptisols; Replace "lithic" with "densic, lithic," in the following places: Definition of Inceptisols items 1.e.(2) and 1.g.; Limits between Inceptisols and other orders, items 2. and 10.b.; Items JA.1. and JAG.; Definition of Aquepts item 1.; All alfic, calcic, cumulic, fluventic, dystric, oxic, rendollic, ultic, vertic, and combination subgroups using one of these subgroups and in the descriptions of the typic subgroups of all great groups using these subgroups; Definition of Ochrepts item 2.; Items JCA.2., JCC.2., and JCD., Definition of Dystrochrepts item 2.; Definition of Eutropepts item 1.; Definition of Humitropepts item 5. and 8.b.; Definition of Umbrepts item 2.

Page 271, Chapter 14 Mollisols; Replace "lithic" with "densic, lithic," in the following places (unless otherwise noted): Definition of Mollisols; Items 1., 2., 3., and 4.b.; Limits between Mollisols and other orders, items 1.a., 2., and 10.b.; Item HB.; All cryic, cumulic, fluventic, oxic, pachic, ultic, and vertic subgroups and combination great groups using these subgroups, and in the descriptions of the typic subgroups of all great groups using these subgroups; Definition of Aquolls; line 2; Typic Duraquolls, item 2.b. delete "lithic or paralithic contact or"; Item HEE.2.; Definition of Aquolls, line 2; Typic Vermiborolls, item 2.; Footnote 1., change "lithic" to "densic, lithic, or paralithic"; Item HGA.2.a.; Item HGD.2., change "lithic" to "densic, lithic, or paralithic"; Definition of Hapludolls, line 2; Definition of Paleudolls; Item HGAA. (Vertic Paleudolls) and in item 3.b. of the definition of Typic Paleudolls, change "lithic or paralithic contact" to "petrocalcic horizon"; Definition of Vermudolls; Item 2.; Items HFC.2.a., HFC.2.b., and HFF.2., change "lithic" to "densic, lithic, or paralithic"; Definition of Argiustolls; Item 1.b.; Definition of Paleustolls; Item 1.a. and 1.b.; Definition of Vermustolls; Item 2.; Item HDC.2.b.; Definition of Argixerolls; Item 2.b.; Definition of Palexerolls; Item 1.b.

Page 323, Chapter 15 Oxisols; Replace "lithic" with "densic, lithic," in the definition of Oxisols, item 3.

Page 333, Chapter 16 Spodosols; Replace "lithic" with "densic, lithic," in the definition of Spodosols, items 3.c.(1), 3.d.(2)(a), and 3.d.(2)(b).

Page 349, Chapter 17 Ultisols; Replace "lithic" with "densic, lithic," in the following places: Definition of Ultisols, items 1.a.(1)(c), 1.a.(2) 1.b.(2), 3., and 4.b.; Limits between Ultisols and other orders, items 1.a.(1)(c), 1.a.(2), 1.a.(3)(b), 2., 3.a., 3.b.(2), 6.a., 6.b.(2) and 9.b.; All vertic subgroups and combination "vertic" subgroups, and in the descriptions of the typic subgroups of all great groups using these subgroups; Definition of Kandiaquults, item 2. Items GBC.1. and GBE.1.; Definition of Kandihumults, item 2.; Items GCC.1. and GCE.1.; Definition of Kandiudults, item 2.; Definition of Paleudults, line 1.; Items GDB.1. and GDD.1.; Definition of Kandiustults, item 2.; Item GEA.1.; Definition of Palexerults, item 1.;

Page 375, Chapter 18 Vertisols; Replace "lithic" with "densic, lithic," in the following places: Definition of Vertisols, items 1. and 4.b. All leptic subgroups and combination "leptic" subgroups, and in the descriptions of the typic subgroups of all great groups using these subgroups.

615.141 Identification of the Taxonomic Class of a Soil.

Page 91, Replace chapter 7 *Identification of the Taxonomic Class of a Soil* from the beginning to "KEY TO SOIL ORDERS" with the following:

"Chapter 7

IDENTIFICATION OF THE TAXONOMIC CLASS OF A SOIL

The taxonomic class of a specific soil can be determined by using the keys that follow in this and other chapters. It is assumed that the reader is familiar with the meanings of the terms used for describing soils that are given in appendix I, II, and III and with the definitions of diagnostic horizons and properties that are given in chapters 3 and 4. The index indicates the pages (boldface type) on which definitions of terms are given.

Conventional rounding conventions should be used to determine numerical values.

Soil colors, (hue, value, and chroma) are used in many of the criteria that follow. Soil colors typically change value and some change hue and chroma depending on the water state. In many of the criteria of the keys, the water state is specified. If no water state is specified, the soil is considered to meet the criterion if it meets the criterion when moist or dry or both moist and dry.

All of the keys in this taxonomy are designed in such a way that the user can determine the correct classification of a soil by going through the key systematically. The user must start at the beginning of the *Key to soil orders* and eliminate, one by one, all classes which include criteria that do not fit the soil in question. The soil belongs to the first class listed for which it meets all the required criteria.

In classifying a specific soil, the user of Soil Taxonomy begins by checking through the *Key to soil orders* to determine the name of the first order which, according to the criteria listed, includes the soil in question. The next step is to go to the page indicated to find the *Key to suborders* of that particular order. Then systematically go through the key to identify the suborder that includes the soil, i.e., the first in the list for which it meets all the required criteria. The same procedure is used to find the soil's great group class in the *Key to great groups* of the identified suborder. Likewise, going through the *Key to subgroups* of that great group, the user selects as the correct subgroup name the name of the first taxon for which the soil meets all of the required criteria.

The family level is determined, in a similar manner, after the subgroup has been determined. Chapter 19 can be used as one would use other keys in this taxonomy to

determine which components are part of the family name. However, the family typically has more than one component, and therefore the entire chapter must be used. The keys to control sections for classes used as components of a family name must be used to determine the control section before using the keys to classes.

The descriptions and definitions of individual soil series are not included in this text. The definition of the series, the control section, and examples of the application are given in Chapter 19. The classification of the series and the list of families and their included series for the soils of the 50 states, Puerto Rico, and the Virgin Islands are given in another publication (Soil Series of the United States, Puerto Rico, and the Virgin Islands: Their Taxonomic Classification, 1990). That publication does not include the descriptions or definitions of the series, but descriptions of specific series are available on request from the Natural Resources Conservation Service. No one publication includes descriptions of all the series.

In the *Key to the orders* and the other keys that follow, the diagnostic horizons and the properties mentioned do not include those below any lithic, paralithic, or petroferric contact. The properties of buried soils and the properties of a surface mantle are considered based on whether or not the soil meets the meaning of the term "buried soil" given in Chapter 1.

If a soil has a surface mantle, and is not a buried soil, the top of the original surface layer is considered the "soil surface" for determining depth to and thickness of diagnostic horizons and most other diagnostic soil characteristics. The only properties of the surface mantle that are considered are soil temperature, soil moisture (including aquic conditions), and any andic or vitrandic properties.

If a soil profile includes a buried soil, the present soil surface is used to determine soil moisture and temperature, and depth to and thickness of diagnostic horizons and other diagnostic soil characteristics. Diagnostic horizons of the buried soil are not considered in selecting taxa unless the criteria in the keys specifically indicate buried horizons, such as in Thapto-histic subgroups. Most other diagnostic soil characteristics of the buried soil are not considered, however organic carbon if holocene age, andic soil properties, base saturation, and all properties used to determine family and series placement are considered."

NSTH 615.115, p. 615-609, Key to soil orders, Aridisols. Item F., 1c., remove "n argillic" and add the following:

"d. An argillic horizon; *or*"

NSTH 615.115, p. 615-611, Definition of Aridisols, change item 2. to read as follows:

"2. Have an ochric or anthropic epipedon and an argillic horizon or one or more of the following with an upper boundary within 100 cm of the soil surface: a calcic, cambic, gypsic, natric, petrocalcic, petrogypsic, or a salic horizon, or a duripan;"

615.142 Particle-size class and texture.

Page 95, column 2, line 15; Change "sandy skeletal particle size" to "sandy-skeletal particle-size class"

Page 96, column 2, line 30; Change "distribution" to "class"

NSTH 615.62, p. 615-305, replace item JDEO. (Calcixerollic Xerochrepts, renumbered to JDFP.) with the following:

"JDFP. Other Xerochrepts that have a calcic horizon or identifiable secondary carbonates, within one of the following particle-size class and depth combinations:

1. A sandy or sandy-skeletal particle-size class and within 150 cm of the mineral soil surface; *or*

2. A clayey, clayey-skeletal, fine, of very fine particle-size class and within 90 cm of the mineral soil surface; *or*

3. Any other particle-size class and within 110 cm of the mineral soil surface

Calcixerollic Xerochrepts"

NSTH 615.62, p., 615-305, column 1 item 6.; Replace with the following:

"6. Do not have a calcic horizon or identifiable secondary carbonates within the following particle-size class and depths combinations:

a. A sandy or sandy-skeletal particle-size class and within a depth of 150 cm of the mineral soil surface; or

b. A clayey, clayey-skeletal, fine, of very fine particle-size class and within a depth of 90 cm of the mineral soil surface; or

c. Any other particle-size class and within a depth of 110 cm of the mineral soil surface."

NSTH 615.79, p., 615-402, column 2, item 2.b.; Replace with the following:

"b. At a depth:

(1) Between 100 cm and 200 cm from the mineral soil surface, if the particle-size class is sandy or sandy-skeletal throughout the upper 100 cm; *or*

(2) Within 100 cm from the mineral soil surface, if the clay content in the fine-earth fraction of the surface horizon is 20 percent or more; *or*

(3) Within 125 cm from the mineral soil surface, for all other soils."

NSTH 615.62, p., 615-323, items: HEGH. (renumbered to HEGI.); HEGI. (renumbered to HEGJ.); HEGJ. (renumbered to HEGK.); Replace item 1. in each with the following:

"1. Have a mollic epipedon 40 cm or more thick, of which less than 50 percent has a sandy or sandy-skeletal particle-size class, and the soil has no densic nor paralithic contact nor any sandy or sandy-skeletal particle-size class between 40 and 50 cm from the mineral soil surface; *and*"

NSTH 615.62, p., 615-324, item: HEGK. (renumbered to HEGL.); Replace with the following:

"HEGL. Other Haploborolls that have a mollic epipedon 40 cm or more thick, of which less than 50 percent has a sandy or sandy-skeletal particle-size class, and the soil has no densic nor paralithic contact nor any sandy or sandy-

skeletal particle-size class between 40 and 50 cm from the mineral soil surface.

Pachic Haploborolls"

NSTH 615.129, p., 615-655, item: HEGH.; Replace item 1. with the following:

"1. A mollic epipedon 40 cm or more thick, of which less than 50 percent has a sandy or sandy-skeletal particle-size class, and the soil has no densic nor paralithic contact nor any sandy or sandy-skeletal particle-size class between 40 and 50 cm from the mineral soil surface; *and*"

NSTH 615.62, p., 615-325, item 9. (renumbered as 10.); Replace with the following:

10. Have a mollic epipedon which is less than 40 cm thick, or more than 50 percent of the mollic epipedon has a sandy or sandy-skeletal particle-size class, or the soil has a densic or paralithic contact or a sandy or sandy-skeletal particle-size class between 40 and 50 cm from the mineral soil surface.

Page 299, column 1, item GFC.2.; (renumbered as HFC.2.); Replace "A particle-size class in the upper part that is clayey" with "Thirty-five percent or more clay in the upper part"

Page 299, column 2, item 1.b.; Replace "A sandy or loamy particle-size class" with "Less than thirty-five percent clay"

Page 307, column 2, item 1.b.; Replace "A a particle-size class in the upper part that is clayey" with "Thirty-five percent or more clay in the upper part"

NSTH 615.62, p. 615-342, item HFCG.; Replace item 1. with the following:

"1. Are calcareous throughout after the soil has been mixed to a depth of 18 cm, and have a calcic horizon within one of the following particle-size class (by weighted average in the particle-size control section) and depth combinations:

a. Sandy or sandy-skeletal and within 100 cm of the mineral soil surface; *or*

b. Clayey, clayey-skeletal, fine or very fine and within 50 cm of the mineral soil surface; *or*

c. Any other class and within 60 cm of the mineral soil surface; *and*"

NSTH 615.62, p. 615-342, item HFCJ., Replace item with the following:

"HFCJ. Other Paleustolls which are calcareous throughout after the soil has been mixed to a depth of 18 cm, and have a calcic horizon within one of the following particle-size class (by weighted average in the particle-size control section) and depth combinations:

1. Sandy or sandy-skeletal and within 100 cm of the mineral soil surface; *or*

2. Clayey, clayey-skeletal, fine or very fine and within 50 cm of the mineral soil surface; *or*

3. Any other class and within 60 cm of the mineral soil surface.

Calcic Paleustolls"

NSTH 615.62, p. 615-343, column 1, item 1., replace item with the following:

"1. Are noncalcareous in some horizon after the soil has been mixed to a depth of 18 cm, or do not have a calcic horizon within one of the following particle-size class (by weighted average in the particle-size control section) and depth combinations:

a. Sandy or sandy-skeletal and within 100 cm of the mineral soil surface; *or*

b. Clayey, clayey-skeletal, fine or very fine and within 50 cm of the mineral soil surface; *or*

c. Any other class and within 60 cm of the mineral soil surface; *and*

Page 311, column 1, item 2.b.; Replace "A sandy or loamy particle-size class" with "Less than 35 percent clay"

NSTH 615.62, p. 615-344, item HDEH. (Calcic Pachic Argixerolls, renumbered to HDEI.); Replace item 1. with the following:

"1. A calcic horizon or identifiable secondary carbonates within one of the following particle-size class (by weighted average in the particle-size control section) and depth combinations:

a. Sandy or sandy-skeletal and within 150 cm of the mineral soil surface; *or*

b. Clayey, clayey-skeletal, fine or very fine and within 90 cm of the mineral soil surface; *or*

c. Any other class and within 110 cm of the mineral soil surface; *and*"

NSTH 615.62, p. 615-345, item HDEO. (Aridic Calcic Argixerolls, renumbered to HDEQ.); Replace item with the following:

"HDEQ. Other Argixerolls that have:

1. A calcic horizon or identifiable secondary carbonates within one of the following particle-size class (by weighted average in the particle-size control section) and depth combinations:

a. Sandy or sandy-skeletal and within 150 cm of the mineral soil surface; *or*

b. Clayey, clayey-skeletal, fine or very fine and within 90 cm of the mineral soil surface; *or*

c. Any other class and within 110 cm of the mineral soil surface; *and*

2. An aridic moisture regime.

Calciargidic Argixerolls"

NSTH 615.62, p. 615-345, item HDEQ. (Calcic Argixerolls, renumbered to HDES.); Replace item with the following:

"HDES. Other Argixerolls that have a calcic horizon or identifiable secondary carbonates within one of the following particle-size class (by weighted average in the particle-size control section) and depth combinations:

1. Sandy or sandy-skeletal and within 150 cm of the mineral soil surface; *or*

2. Clayey, clayey-skeletal, fine or very fine and within 90 cm of the mineral soil surface; *or*

3. Any other class and within 110 cm of the mineral soil surface.

Calcic Argixerolls"

NSTH 615.62, p. 615-345, column 2, item 3.; Replace with the following:

"3. Do not have a calcic horizon or identifiable secondary carbonates within one of the following particle-size class (by weighted average in the particle-size control section) and depth combinations:

a. Sandy or sandy-skeletal and within 150 cm of the mineral soil surface; *or*

b. Clayey, clayey-skeletal, fine or very fine and within 90 cm of the mineral soil surface; *or*

c. Any other class and within 110 cm of the mineral soil surface;"

NSTH 615.62, p. 615-349, item HDFI. (Calcic Pachic Haploxerolls, renumbered to HDFJ.); Replace item 2. with the following:

"2. A calcic horizon or identifiable secondary carbonates within one of the following particle-size class (by weighted average in the particle-size control section) and depth combinations:

a. Sandy or sandy-skeletal and within 150 cm of the mineral soil surface; *or*

b. Clayey, clayey-skeletal, fine or very fine and within 90 cm of the mineral soil surface; *or*

c. Any other class and within 110 cm of the mineral soil surface; *and*"

NSTH 615.62, p. 615-349, item HDFR. (renamed to Calcidic Haploxerolls, and renumbered to HDFT.); Replace item 2. with the following:

"2. A calcic horizon or identifiable secondary carbonates within one of the following particle-size class (by weighted average in the particle-size control section) and depth combinations:

a. Sandy or sandy-skeletal and within 150 cm of the mineral soil surface; *or*

b. Clayey, clayey-skeletal, fine or very fine and within 90 cm of the mineral soil surface; *or*

c. Any other class and within 110 cm of the mineral soil surface; *and*"

NSTH 615.62, p. 615-350, item HDFS., item 2. (Torripsammentic Haploxerolls, renumbered to HDFU.); Replace "A sandy particle size" with "A sandy particle-size class"

NSTH 615.62, p. 615-350, item HDFY. (Calcic Haploxerolls, renumbered to HDFZa.); Replace item with the following:

"HDFZa. Other Haploxerolls that have a calcic horizon or identifiable secondary carbonates within one of the following particle-size class (by weighted average in the particle-size control section) and depth combinations:

a. Sandy or sandy-skeletal and within 150 cm of the mineral soil surface; *or*

b. Clayey, clayey-skeletal, fine or very fine and within 90 cm of the mineral soil surface; *or*

c. Any other class and within 110 cm of the mineral soil surface.

Calcic Haploxerolls"

NSTH 615.62, p. 615-350, column 2, item 2.; Replace with the following:

"2. Do not have a calcic horizon or identifiable secondary carbonates within one of the following particle-size class (by weighted average in the particle-size control section) and depth combinations:

a. Sandy or sandy-skeletal and within 150 cm of the mineral soil surface; *or*

b. Clayey, clayey-skeletal, fine or very fine and within 90 cm of the mineral soil surface; *or*"

c. Any other class and within 110 cm of the mineral soil surface

Page 320, column 2, item 1.b.; Replace "A particle-size class in the upper part that is clayey" with "Thirty-five percent or more clay in the upper part"

NSTH 615.62, p. 615-352, item HDCI. (Haplic Palexerolls); Replace HDCI. with the following:

"HDCI. Other Palexerolls which have an argillic horizon that has *either*:

1. Less than 35 percent clay in the upper part; *or*

2. At its upper boundary, has a clay increase that is *both* less than 20 percent (absolute) within a vertical distance of 7.5 cm, *and* is less than 15 percent (absolute) within a vertical distance of 2.5 cm, in the fine earth fraction.

Haplic Palexerolls"

NSTH 615.62, p. 615-352, column 1, item 1.; Replace "a clayey particle-size class" with "35 percent or more clay".

NSTH 615.91, p. 615-572, column 1, line 38; Change "particle size" to "particle-size class"

NSTH 615.45, p. 615-112, (Oxic Horizon) line 2; Change "particle size" to "texture"

NSTH 615.45, p. 615-122, line 3; Change "particle-size" to "texture"

NSTH 615.45, p. 615-122, line 10; Change "particle-size distribution class" to "particle size distribution"

NSTH 615.45, p. 615-115, line 14; Replace "certain coarse particle-size classes" with "sandy textures"

NSTH 615.45, p. 615-115, line 24; Replace "coarser particle size" with "a coarser textured"

NSTH 615.45, p. 615-117, item 2.; Replace "particle-size" with "texture"

NSTH 615.45, p. 615-118, item 5.; Delete "particle-size".

NSTH 615.91, p. 615-577, column 2, item 3.a.(4); Replace "particle size" with "particle-size class"

NSTH 615.91, p. 615-577, column 2, item 3.b.(2); Replace "sandy particle size" with "sandy or sandy-skeletal particle-size class"

615.143 Arenic and Grossarenic subgroups

Correct all of the following Arenic and Grossarenic subgroups (and combinations) criteria and definitions by

replacing "sandy particle size" with "sandy or sandy-skeletal particle-size class":

NSTH 615.62, p. 615-209 item IAGA.; NSTH 615.89, p. 615-428, items IAJB. and IAJC.; NSTH 615.89, p. 615-430, items IAIC. and IAID. (changed to IAIF. and IAIG.); NSTH 615.62, p. 615-210 and 211 items IAFA. and IAFB.; NSTH 615.62, p. 615-211 items IAEA. and IAEB.; NSTH 615.62, p. 615-215 items IAHB. and IAHC.; NSTH 615.62, p. 615-216 and 217 items IBED. and IBEH. (changed to IBEE. and IBEJ.); NSTH 615.62, p. 615-221 items IEDC. (changed to IEEG.); NSTH 615.62, p. 615-222 and 223 items IEKH. and IEKI. (changed to IEKL. and IEKM.); NSTH 615.62, p. 615-225 items IEGC., IEGD., IEGE., and IEGF. (changed to IEGD., IEGE., IEGF., and IEGG.); NSTH 615.62, p. 615-227 items IEIF., IEIG., IEIL., and IEIJ. (changed to IEIH., IEII., IEIK., and IEIL.); NSTH 615.62, p. 615-228 and 229 items ICHD., ICHH., and ICHI. (changed to ICHF., ICHK., and ICHL.); NSTH 615.62, p. 615-230 items ICDA., ICDB., ICDE., and ICDF.; NSTH 615.62, p. 615-232 items ICCA., ICCB., and ICCD. (changed to ICCB., ICCC., and ICCE.); NSTH 615.62, p. 615-233 and 234 items ICFD., ICFE., ICFI., and ICFJ. (changed to ICFK., ICFE., ICFJ., and ICFL.); NSTH 615.62, p. 615-240 item IDFF., (changed to IDFG.); NSTH 615.115, p 615-612 items FEEF. and FEEG.; NSTH 615.115, p 615-615 items FEFI. and FEFJ.; NSTH 615.115, p 615-618 items FECC. and FECD.; NSTH 615.62, p. 615-300 item JDFK. (changed to JDGM.); NSTH 615.62, p. 615-314 items HBEA. and HBEB.; NSTH 615.102, p. 615-600 item HEDB.; NSTH 615.91, p. 615-579, items BABD., BABE., BABF., and BABG.; NSTH 615.91, p. 615-587 and 588, items BDDB., BDDC., BDDD., and BDDF.; NSTH 615.89, p. 615-507 items GAIA., and GAIB.; NSTH 615.89, p. 615-508 items GAHB., and GAHC.; NSTH 615.62, p. 615-366 items GADB., GADC., GADD., and GADE.; NSTH 615.62, p. 615-367 items GAFA., GAFB., GAFC., and GAFD. (changed to GAFB., GAFC., GAFD., and GAFE.); NSTH 615.62, p. 615-371 item GCBA.; NSTH 615.62, p. 615-372 items GCGE. and GCGF.; NSTH 615.62, p. 615-373 and 374, items GCCA., GCCB., GCCC., GCCD., GCCE.; GCCF., and GCCG.; NSTH 615.62, p. 615-375, items GCDB., and GCDC.; NSTH 615.62, p. 615-377, items GCED., GCEE., GCEF., GCEG., GCEH.; GCEI., and GCEJ., (changed to GCEE., GCEF., GCEG., GCEH.; GCEI., GCEJ., and GCEK.); NSTH 615.62, p. 615-379, item GDFD.; NSTH 615.62, p. 615-380, items GDBC., and GDBD.; NSTH 615.62, p. 615-381, item GDCD.; NSTH 615.62, p. 615-383, items GEBE., and GEBF.;

615.144 Changes to Aqualfs and Aeric subgroups of Aqualfs

Page 96, NSTH 615.89 p. 615-427 item HA. Aqualfs (changed to IA.); Line 2 following "aquic conditions" add:

", other than anthraquic conditions,"

Page 96, NSTH 615.89 p. 615-427 item HA.1. Aqualfs (changed to IA.1.); Change the last line of the item to read:

"argillic, natric, glossic, or kandic horizons:"

NSTH 615.62, p. 615-211, change item IAFC. to read:

"IAFC. Other Glossaqualfs that have, in one or more horizons between the A or Ap horizon and a depth of 75 cm below the mineral soil surface, in 50 percent or more of the matrix, one, or a combination, of the following colors:

1. Hue of 7.5YR or redder; *and*

a. Peds present and a chroma of 2 or more (both moist and dry) on 50 percent or more of ped exteriors, *or* no redox depletions with a chroma of 2 or less (both moist and dry) in ped interiors; *or*

b. No peds present and a chroma of 2 or more (both moist and dry); *or*

2. Hue of 10YR or yellower *and either*

a. Both a color value, moist, and chroma of 3 or more (both moist and dry); *or*

b. A chroma of 2 or more (both moist and dry) and no redox concentrations.

Aeric Glossaqualfs"

NSTH 615.62, p. 615-211, definition of Typic Glossaqualfs; Change item 1. to read:

"1. Have, in all horizons between the A or Ap horizon and a depth of 75 cm below the mineral soil surface, less than 50 percent of the matrix, one, or a combination, of the following colors:

a. Hue of 7.5YR or redder; *and*

(1) Peds present and a chroma of 2 or more (both moist and dry) on 50 percent or more of ped exteriors, *or* no redox depletions with a chroma of 2 or less (both moist and dry) in ped interiors; *or*

(2) No peds present and a chroma of 2 or more (both moist and dry); *or*

b. Hue of 10YR or yellower *and either*

(1) Both a color value, moist, and chroma of 3 or more (both moist and dry); *or*

(2) A chroma of 2 or more (both moist and dry) and no redox concentrations;"

NSTH 615.125, p. 615-649, change item IAJD. (Udollic Endoaqualfs) to read:

"IAJD. Other Endoaqualfs which have *both*:

1. A mollic epipedon, or an Ap horizon that meets all the requirements for a mollic epipedon except thickness, or materials between the soil surface and a depth of 18 cm that meet these requirements after mixing; *and*

2. In one or more horizons between the A or Ap horizon and a depth of 75 cm below the mineral soil surface, in 50 percent or more of the matrix, one, or a combination, of the following colors:

1. Hue of 7.5YR or redder; *and*

a. Peds present and a chroma of 2 or more (both moist and dry) on 50 percent or more of ped exteriors, *or* no redox depletions with a chroma of 2 or less (both moist and dry) in ped interiors; *or*

b. No peds present and a chroma of 2 or more (both moist and dry); *or*

2. Hue of 10YR or yellower *and either*

a. Both a color value, moist, and chroma of 3 or more (both moist and dry); *or*

b. A chroma of 2 or more (both moist and dry) and no redox concentrations.

Udollic Endoaqualfs"

NSTH 615.89, p. 615-428, change item IAJD. (Aeric Endoaqualfs, changed to item IAJE.) to read:

"IAJE. Other Endoaqualfs that have, in one or more horizons between the A or Ap horizon and a depth of 75 cm below the mineral soil surface, in 50 percent or more of the matrix, one, or a combination, of the following colors:

1. Hue of 7.5YR or redder; *and*

a. Peds present and a chroma of 2 or more (both moist and dry) on 50 percent or more of ped exteriors, *or* no redox depletions with a chroma of 2 or less (both moist and dry) in ped interiors; *or*

b. No peds present and a chroma of 2 or more (both moist and dry); *or*

2. Hue of 10YR or yellower *and either*

a. Both a color value, moist, and chroma of 3 or more (both moist and dry); *or*

b. A chroma of 2 or more (both moist and dry) and no redox concentrations.

Aeric Endoaqualfs"

NSTH 615.89, p. 615-429, defmition of Typic Endoaqualfs; Change item 1. to read:

"1. Have, in all horizons between the A or Ap horizon and a depth of 75 cm below the mineral soil surface, less than 50 percent of the matrix, one, or a combination, of the following colors:

a. Hue of 7.5YR or redder; *and*

(1) Peds present and a chroma of 2 or more (both moist and dry) on 50 percent or more of ped exteriors, *or* no redox depletions with a chroma of 2 or less (both moist and dry) in ped interiors; *or*

(2) No peds present and a chroma of 2 or more (both moist and dry); *or*

b. Hue of 10YR or yellower *and either*

(1) Both a color value, moist, and chroma of 3 or more (both moist and dry); *or*

(2) A chroma of 2 or more (both moist and dry) and no redox concentrations;"

NSTH 615.126, p. 615-650, change item IAIA. and IAIB. as follows:

"IAIA. Epiaqualfs which have *all* of the following:

1. *One or both*:

a. Cracks within 125 cm of the mineral soil surface that are 5 mm or more wide through a thickness of 30 cm or more for some time in most years, and slickensides or wedge-shaped aggregates in a layer 15 cm or more thick that has its upper boundary within 125 cm of the mineral soil surface; *or*

b. A linear extensibility of 6.0 cm or more between the mineral soil surface and either a depth of 100 cm or a densic, lithic, or paralithic contact, whichever is shallower; *and*

2. In one or more horizons between the A or Ap horizon and a depth of 75 cm below the mineral soil surface, in 50 percent or more of the matrix, one, or a combination, of the following colors:

a. Hue of 7.5YR or redder; *and*

(1) Peds present and a chroma of 2 or more (both moist and dry) on 50 percent or more of ped exteriors, *or* no redox depletions with a chroma of 2 or less (both moist and dry) in ped interiors; *or*

(2) No peds present and a chroma of 2 or more (both moist and dry); *or*

b. Hue of 10YR or yellower *and either*

(1) Both a color value, moist, and chroma of 3 or more (both moist and dry); *or*

(2) A chroma of 2 or more (both moist and dry) and no redox concentrations; *and*

3. An Ap horizon or materials between the mineral soil surface and 18 cm that after mixing meet *one or more* the following colors;

a. A color value, moist, of 4 or more; *or*

b. A color value, dry, of 6 or more; *or*

c. A chroma of 4 or more.

Aeric Chromic Vertic Epiaqualfs

IAIB. Other Epiaqualfs which have *both* of the following:

1. *One or both*:

a. Cracks within 125 cm of the mineral soil surface that are 5 mm or more wide through a thickness of 30 cm or more for some time in most years, and slickensides or wedge-shaped aggregates in a layer 15 cm or more thick that has its upper boundary within 125 cm of the mineral soil surface; *or*

b. A linear extensibility of 6.0 cm or more between the mineral soil surface and either a depth of 100 cm or a densic, lithic, or paralithic contact, whichever is shallower; *and*

2. In one or more horizons between the A or Ap horizon and a depth of 75 cm below the mineral soil surface, in 50 percent or more of the matrix, one, or a combination, of the following colors:

a. Hue of 7.5YR or redder; *and*

(1) Peds present and a chroma of 2 or more (both moist and dry) on 50 percent or more of ped exteriors, *or* no redox depletions with a chroma of 2 or less (both moist and dry) in ped interiors; *or*

(2) No peds present and a chroma of 2 or more (both moist and dry); *or*

b. Hue of 10YR or yellower *and either*

(1) Both a color value, moist, and chroma of 3 or more (both moist and dry); *or*

(2) A chroma of 2 or more (both moist and dry) and no redox concentrations.

Aeric Vertic Epiaqualfs"

NSTH 615.89, p. 615-430, change items IAIE. (Aeric Umbric Epiaqualfs, changed to IAIH.), IAIF. (Udollic Epiaqualfs, changed to IAII.), and IAIG. (Aeric Epiaqualfs, changed to IAIJ.), as follows:

"IAIH. Other Epiaqualfs which have:

1. An Ap horizon that meets all the requirements for an umbric epipedon except thickness, or materials between the soil surface and a depth of 18 cm that meet these requirements after mixing; *and*

2. In one or more horizons between the A or Ap horizon and a depth of 75 cm below the mineral soil surface, in 50 percent or more of the matrix, one, or a combination, of the following colors:

a. Hue of 7.5YR or redder; *and*

(1) Peds present and a chroma of 2 or more (both moist and dry) on 50 percent or more of ped exteriors, *or* no redox depletions with a chroma of 2 or less (both moist and dry) in ped interiors; *or*

(2) No peds present and a chroma of 2 or more (both moist and dry); *or*

b. Hue of 10YR or yellower *and either*

(1) Both a color value, moist, and chroma of 3 or more (both moist and dry); *or*

(2) A chroma of 2 or more (both moist and dry) and no redox concentrations.

Aeric Umbric Epiaqualfs

IAII. Other Epiaqualfs which have *both*:

1. A mollic epipedon, or an Ap horizon that meets all the requirements for a mollic epipedon except thickness, or materials between the soil surface and a depth of 18 cm that meet these requirements after mixing; *and*

2. In one or more horizons between the A or Ap horizon and a depth of 75 cm below the mineral soil surface, in 50 percent or more of the matrix, one, or a combination, of the following colors:

a. Hue of 7.5YR or redder; *and*

(1) Peds present and a chroma of 2 or more (both moist and dry) on 50 percent or more of ped exteriors, *or* no redox depletions with a chroma of 2 or less (both moist and dry) in ped interiors; *or*

(2) No peds present and a chroma of 2 or more (both moist and dry); *or*

b. Hue of 10YR or yellower *and either*

(1) Both a color value, moist, and chroma of 3 or more (both moist and dry); *or*

(2) A chroma of 2 or more (both moist and dry) and no redox concentrations.

Udollic Epiaqualfs

IAIJ. Other Epiaqualfs that have, in one or more horizons between the A or Ap horizon and a depth of 75 cm below the mineral soil surface, in 50 percent or more of the matrix, one, or a combination, of the following colors:

1. Hue of 7.5YR or redder; *and*

a. Peds present and a chroma of 2 or more (both moist and dry) on 50 percent or more of ped exteriors, *or* no redox depletions with a chroma of 2 or less (both moist and dry) in ped interiors; *or*

b. No peds present and a chroma of 2 or more (both moist and dry); *or*

2. Hue of 10YR or yellower *and either*

a. Both a color value, moist, and chroma of 3 or more (both moist and dry); *or*

b. A chroma of 2 or more (both moist and dry) and no redox concentrations.

Aeric Epiaqualfs"

NSTH 615.89, p. 615-431, definition of Typic Epiaqualfs; Change item 1. to read:

"1. Have, in all horizons between the A or Ap horizon and a depth of 75 cm below the mineral soil surface, less than 50 percent of the matrix, one, or a combination, of the following colors:

a. Hue of 7.5YR or redder; *and*

(1) Peds present and a chroma of 2 or more (both moist and dry) on 50 percent or more of ped exteriors, *or* no redox depletions with a chroma of 2 or less (both moist and dry) in ped interiors; *or*

(2) No peds present and a chroma of 2 or more (both moist and dry); *or*

b. Hue of 10YR or yellower *and either*

(1) Both a color value, moist, and chroma of 3 or more (both moist and dry); *or*

(2) A chroma of 2 or more (both moist and dry) and no redox concentrations;"

NSTH 615.89, p. 615-433, change items IAED. (Aeric Umbric Kandiaqualfs) and IAEE. (Aeric Kandiaqualfs), as follows:

"IAED. Other Kandiaqualfs which have:

1. An Ap horizon that meets all the requirements for an umbric epipedon except thickness, or materials between the soil surface and a depth of 18 cm that meet these requirements after mixing; *and*

2. In one or more horizons between the A or Ap horizon and a depth of 75 cm below the mineral soil surface, in 50 percent or more of the matrix, one, or a combination, of the following colors:

a. Hue of 7.5YR or redder; *and*

(1) Peds present and a chroma of 2 or more (both moist and dry) on 50 percent or more of ped exteriors, *or* no redox depletions with a chroma of 2 or less (both moist and dry) in ped interiors; *or*

(2) No peds present and a chroma of 2 or more (both moist and dry); *or*

b. Hue of 10YR or yellower *and either*

(1) Both a color value, moist, and chroma of 3 or more (both moist and dry); *or*

(2) A chroma of 2 or more (both moist and dry) and no redox concentrations.

Aeric Umbric Kandiaqualfs

IAEE. Other Kandiaqualfs which have in one or more horizons between the A or Ap horizon and a depth of 75 cm below the mineral soil surface, in 50 percent or more of the matrix, one, or a combination, of the following colors:

1. Hue of 7.5YR or redder; *and*

a. Peds present and a chroma of 2 or more (both moist and dry) on 50 percent or more of ped exteriors, *or* no redox depletions with a chroma of 2 or less (both moist and dry) in ped interiors; *or*

b. No peds present and a chroma of 2 or more (both moist and dry); *or*

2. Hue of 10YR or yellower *and either*

a. Both a color value, moist, and chroma of 3 or more (both moist and dry); *or*

b. A chroma of 2 or more (both moist and dry) and no redox concentrations.

Aeric Kandiaqualfs"

NSTH 615.89, p. 615-434, definition of Typic Kandiaqualfs; Change item 1. to read:

"1. Have, in all horizons between the A or Ap horizon and a depth of 75 cm below the mineral soil surface, less than 50 percent of the matrix, one, or a combination, of the following colors:

a. Hue of 7.5YR or redder; *and*

(1) Peds present and a chroma of 2 or more (both moist and dry) on 50 percent or more of ped exteriors, *or* no redox depletions with a chroma of 2 or less (both moist and dry) in ped interiors; *or*

(2) No peds present and a chroma of 2 or more (both moist and dry); *or*

b. Hue of 10YR or yellower *and either*

(1) Both a color value, moist, and chroma of 3 or more (both moist and dry); *or*

(2) A chroma of 2 or more (both moist and dry) and no redox concentrations;"

615.145 Changing "Ustic" Boralfs to Ustalfs and adding new subgroups

Page 109, Item HB.1. "Boralfs" (changed to IB.1.). Replace item 1. with the following:

"1. A frigid temperature regime, *and neither* a xeric *nor* ustic moisture regime; *or*"

NSTH 615.62, p. 615-216 and 615-217, renumber IBEB. through IBEK. (renumbered as IBEB. to IBEM.) as IBEC. through IBES. and add the following:

"IBEB. Other Eutroboralfs which have both:

1. One or both of the following:

a. Cracks within 125 cm of the mineral soil surface that are 5 mm or more wide through a thickness of 30 cm or more for some time in most years, and slickensides or wedge-shaped aggregates in a layer 15 cm or more thick that has its upper boundary within 125 cm of the mineral soil surface; *or*

b. A linear extensibility of 6.0 or more between the mineral soil surface and either a depth of 100 cm or a densic, lithic, or paralithic contact,

whichever is shallower; *and*

2. Redox depletions with a chroma of 2 or less in layers that also have aquic conditions in most years (or artificial drainage) either:

a. Within the upper 25 cm of the argillic horizon if its upper boundary is within 50 cm of the mineral soil surface; or

b. Within 75 cm of the mineral soil surface if the upper boundary of the argillic horizon is 20 cm or more below the mineral soil surface.

Aquertic Eutroboralfs"

Page 139 and NSTH 615.62, p. 615-228 before item ICHB. (Changed to ICHD., Udertic Haplustalfs). Change items ICHD. through ICHL. to ICHE. through ICHM. and add the following:

"ICHD. Other Haplustalfs that have *both* of the following:

1. If neither irrigated nor fallowed to store moisture, have *either*:

a. A frigid temperature regime, and a moisture control section which, in 6 or more years out of 10 years, is dry in all parts for four-tenths or more of the cumulative days per year when the soil temperature at a depth of 50 cm below the soil surface is higher than 5°C; *or*

b. A mesic or thermic soil temperature regime, *and* a moisture control section which, in 6 or more out of 10 years, is dry in some part for six tenths or more of the cumulative days per year when the soil temperature at a depth of 50 cm below the soil surface is higher than 5°C; *or*

c. A hyperthermic, an isomesic, or a warmer *iso* soil temperature regime, *and* a moisture control section which, in 6 or more out of 10 years, remains moist in some or all parts for less than 90 consecutive days per year when the temperature at a depth of 50 cm below the soil surface is higher than 8°C; *and*

2. *One or both* of the following:

a. Cracks within 125 cm of the mineral soil surface that are 5 mm or more wide through a thickness of 30 cm or more for some time in most years, and slickensides or wedge-shaped aggregates in a layer 15 cm or more thick that has its upper boundary within 125 cm of the mineral soil surface; *or*

b. A linear extensibility of 6.0 cm or more between the mineral soil surface and either a depth of 100 cm or a densic, lithic, or paralithic contact, whichever is shallower.

Torrertic Haplustalfs"

Page 139, NSTH 615.62, p. 615-229, item ICHH. (Arenic Aridic Haplustalfs) (changed to ICHL. above). Change items 1.a. and 1.b. to 1.b. and 1.c. and add the following as 1.a.:

"a. A frigid temperature regime, and a moisture control section which, in 6 or more years out of 10 years, is dry in all parts for four-tenths or more of the cumulative days per year when the soil temperature at a depth of 50 cm below the soil surface is higher than 5°C; *or*"

Page 139 and NSTH 615.62, p. 615-229. Following item ICHI. (Changed to ICHM. above, Arenic Haplustalfs). Change items ICHM. and ICHN. to ICHO. and ICHP. and add the following:

"ICHM. Other Haplustalfs which have *both*:

1. A calcic horizon with its upper boundary within 100 cm of the mineral soil surface; *and*

2. If neither irrigated nor fallowed to store moisture, *either*:

a. A frigid temperature regime, and a moisture control section which, in 6 or more years out of 10 years, is dry in all parts for four-tenths or more of the cumulative days per year when the soil temperature at a depth of 50 cm below the soil surface is higher than 5°C; *or*

b. A mesic or thermic soil temperature regime, *and* a moisture control section which, in 6 or more out of 10 years, is dry in some part for six tenths or more of the cumulative days per year when the soil temperature at a depth of 50 cm below the soil surface is higher than 5°C; *or*

c. A hyperthermic, an isomesic, or a warmer *iso* soil temperature regime, *and* a moisture control section which, in 6 or more out of 10 years, remains moist in some or all parts for less than 90 consecutive days per year when the temperature at a depth of 50 cm below the soil surface is higher than 8°C.

Calcidic Haplustalfs"

Page 139, NSTH 615.62, p. 615-229. Item ICHJ. (Aridic Haplustalfs, changed to ICHO. above). Renumber items 1. and 2. as 2. and 3. and add new item 1. as follows:

"1. A frigid temperature regime, and a moisture control section which, in 6 or more years out of 10 years, is dry in all parts for four-tenths or more of the cumulative days per year when the soil temperature at a depth of 50 cm below the soil surface is higher than 5°C; *or*"

Page 139, NSTH 615.62, p. 615-229. Following item ICHN. (Changed to ICHP. above, Kanhaplic Haplustalfs). Change items ICHO. through ICHQ. to ICHS. through ICHU and add the following:

"ICHQ. Other Haplustalfs which have both:

1. A calcic horizon with its upper boundary within 100 cm of the mineral soil surface; *and*

2. If neither irrigated nor fallowed to store moisture, have *either*:

a. A frigid soil temperature regime, and a moisture control section which, in 6 or more out of 10 years, is dry in some or all parts for less than 105 cumulative days per year when the temperature at a depth of 50 cm below the soil surface is higher than 5°C; *or*

b. A mesic or thermic soil temperature regime, and a moisture control section which, in 6 or more out of 10 years, is dry in some part for four tenths or less of the cumulative days per year when the temperature at a depth of 50 cm below the soil surface is higher than 5°C; *or*

c. A hyperthermic, an isomesic, or a warmer *iso* soil temperature regime, and a moisture control section which, in 6 or more out of 10 years, is dry in some or all parts for less than 120 cumulative days per year when the temperature at a depth of 50 cm below the soil surface is higher than 8°C.

Calcic Udic Haplustalfs

ICHR. Other Haplustalfs that have a calcic horizon with its upper boundary within 100 cm of the mineral soil surface.

Calcic Haplustalfs"

Page 139 and NSTH 615.62, p. 615-229, following item ICHM. (Changed to ICHT. above) (Udic Haplustalfs). Renumber items 1. and 2. as 2. and 3 and add the following:

"1. A frigid soil temperature regime, and a moisture control section which, in 6 or more out of 10 years, is dry in some or all parts for less than 105 cumulative days per year when the temperature at a depth of 50 cm below the soil surface is higher than 5°C; *or*"

NSTH 615.62, p. 615-230, Definition of Typic Haplustalfs; Add the following new item 6.a. and renumber items 6.a and 6.b as 6.b and 6.c.:

"a. A frigid soil temperature regime, and a moisture control section which, in 6 or more out of 10 years, is dry in some or all parts for 105 or more cumulative days per year when the temperature at a depth of 50 cm below the soil surface is higher than 5°C;"

NSTH 615.62, p. 615-230, Definition of Typic Haplustalfs; Add the following new item 9.a., renumber items 9.a and 9.b as 9.b and 9.c. and add new item 10.:

"a. A frigid temperature regime, and a moisture control section which, in 6 or more years out of 10 years, is dry in all parts for less than four-tenths or more of the cumulative days per year when the soil temperature at a depth of 50 cm below the soil surface is higher than 5°C; *or*"

"10. Do not have a calcic horizon with its upper boundary within 100 cm of the mineral soil surface."

Page 141, NSTH 615.62, p. 615-232 and NSTH 615.90, p. 615-519; Renumber and move item ICCF. (changed to ICCG. salidic Natrustalfs) before item ICCA. (Vertic Natrustalfs) and add the following new items:

"ICCB. Natrustalfs that have *all* of the following:

1. Visible crystals of gypsum or other salts more soluble than gypsum or both within 40 cm of the mineral soil surface; *and*

2. If neither irrigated nor fallowed to store moisture, have *either*:

a. A frigid temperature regime, and a moisture control section which, in 6 or more years out of 10 years, is dry in all parts for four-tenths or more of the cumulative days per year when the soil temperature at a depth of 50 cm below the soil surface is higher than 5°C; *or*

b. A mesic or thermic soil temperature regime, *and* a moisture control section which, in 6 or more out of 10 years, is dry in some part for six tenths or more of the cumulative days per year when the soil temperature at a depth of 50 cm below the soil surface is higher than 5°C; *or*

c. A hyperthermic, an isomesic, or a warmer *iso* soil temperature regime, *and* a moisture control section which, in 6 or more out of 10 years, remains moist in some or all parts for less than 90 consecutive days per year when the temperature at a depth of 50 cm below the soil surface is higher than 8°C; *and*

3. *One or both* of the following:

a. Cracks within 125 cm of the mineral soil surface that are 5 mm or more wide through a thickness of 30 cm or more for some time in most years, and slickensides or wedge-shaped aggregates in a layer 15 cm or more thick that has its upper boundary within 125 cm of the mineral soil surface; *or*

b. A linear extensibility of 6.0 cm or more between the mineral soil surface and either a depth of 100 cm or a densic, lithic, or paralithic contact, whichever is shallower.

Leptic Torrertic Natrustalfs

ICCC. Other Natrustalfs that have *both* of the following:

1. If neither irrigated nor fallowed to store moisture, have *either*:

a. A frigid temperature regime, and a moisture control section which, in 6 or more years out of 10 years, is dry in all parts for four-tenths or more of the cumulative days per year when the soil temperature at a depth of 50 cm below the soil surface is higher than 5°C; *or*

b. A mesic or thermic soil temperature regime, *and* a moisture control section which,

in 6 or more out of 10 years, is dry in some part for six tenths or more of the cumulative days per year when the soil temperature at a depth of 50 cm below the soil surface is higher than 5°C; *or*

c. A hyperthermic, an isomesic, or a warmer *iso* soil temperature regime, *and* a moisture control section which, in 6 or more out of 10 years, remains moist in some or all parts for less than 90 consecutive days per year when the temperature at a depth of 50 cm below the soil surface is higher than 8°C; *and*

2. *One or both* of the following:

a. Cracks within 125 cm of the mineral soil surface that are 5 mm or more wide through a thickness of 30 cm or more for some time in most years, and slickensides or wedge-shaped aggregates in a layer 15 cm or more thick that has its upper boundary within 125 cm of the mineral soil surface; *or*

b. A linear extensibility of 6.0 cm or more between the mineral soil surface and either a depth of 100 cm or a densic, lithic, or paralithic contact, whichever is shallower.

Torrertic Natrustalfs

ICCD. Other Natrustalfs which have *both*:

1. In one or more horizons within 75 cm of the mineral soil surface, redox depletions with a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage); *and*

2. *One or both* of the following:

a. Cracks within 125 cm of the mineral soil surface that are 5 mm or more wide through a thickness of 30 cm or more for some time in most years, and slickensides or wedge-shaped aggregates in a layer 15 cm or more thick that has its upper boundary within 125 cm of the mineral soil surface; *or*

b. A linear extensibility of 6.0 cm or more between the mineral soil surface and either a depth of 100 cm or a densic, lithic, or paralithic contact, whichever is shallower.

Aquertic Natrustalfs

ICCD. Other Natrustalfs that have *both* of the following:

1. Visible crystals of gypsum or other salts more soluble than gypsum or both within 40 cm of the mineral soil surface; *and*

2. If neither irrigated nor fallowed to store moisture, have *either*:

a. A frigid temperature regime, and a moisture control section which, in 6 or more years out of 10 years, is dry in all parts for four-tenths or more of the cumulative days per year when the soil temperature at a depth of 50 cm below the soil surface is higher than 5°C; *or*

b. A mesic or thermic soil temperature regime, *and* a moisture control section which, in 6 or more out of 10 years, is dry in some part for six tenths or more of the cumulative days per year when the soil temperature at a depth of 50 cm below the soil surface is higher than 5°C; *or*

c. A hyperthermic, an isomesic, or a warmer *iso* soil temperature regime, *and* a moisture control section which, in 6 or more out of 10 years, remains moist in some or all parts for less than 90 consecutive days per year when the temperature at a depth of 50 cm below the soil surface is higher than 8°C.

Aridic Leptic Natrustalfs"

Page 141, NSTH 615.62, p. 615-232 and NSTH 615.90, p. 615-519; Renumber ICCA. through ICCE. as ICCF. through ICCK. and following item ICCE. (changed to ICCK. above) add:

"ICCL. Other Natrustalfs that have visible crystals of gypsum or other salts more soluble than gypsum or both within 40 cm of the mineral soil surface.

Leptic Natrustalfs

ICCM. Other Natrustalfs that have *both* of the following:

1. An exchangeable sodium percentage of less than 15 (or a sodium adsorption ratio of less than 13) in 50 percent or more of the natric horizon; *and*

2. If neither irrigated nor fallowed to store moisture, have *either*:

a. A frigid temperature regime, and a moisture control section which, in 6 or more years out of 10 years, is dry in all parts for four-tenths or more of the cumulative days per year when the soil temperature at a depth of 50 cm below the soil surface is higher than 5°C; *or*

b. A mesic or thermic soil temperature regime, *and* a moisture control section which, in 6 or more out of 10 years, is dry in some part for six tenths or more of the cumulative days per year when the soil temperature at a depth of 50 cm below the soil surface is higher than 5°C; *or*

c. A hyperthermic, an isomesic, or a warmer *iso* soil temperature regime, *and* a moisture control section which, in 6 or more out of 10 years, remains moist in some or all parts for less than 90 consecutive days per year when the temperature at a depth of 50 cm below the soil surface is higher than 8°C.

Haplargidic Natrustalfs

ICCN. Other Natrustalfs that if neither irrigated nor fallowed to store moisture, have *either*:

1. A frigid temperature regime, and a moisture control section which, in 6 or more years out of 10 years, is dry in all parts for four-tenths or more of the cumulative days per year when the soil temperature at a depth of 50 cm below the soil surface is higher than 5°C; *or*

2. A mesic or thermic soil temperature regime, *and* a moisture control section which, in 6 or more out of 10 years, is dry in some part for six tenths or more of the cumulative days per year when the soil temperature at a depth of 50 cm below the soil surface is higher than 5°C; *or*

3. A hyperthermic, an isomesic, or a warmer *iso* soil temperature regime, *and* a moisture control section which, in 6 or more out of 10 years, remains moist in some or all parts for less than 90 consecutive days per year when the temperature at a depth of 50 cm below the soil surface is higher than 8°C.

Aridic Natrustalfs"

Page 141, NSTH 615.62, p. 615-232 and NSTH 615.90, p. 615-519; Renumber items ICCG. and ICCH. as items ICCO. and ICCP.

NSTH 615.62, p. 615-232, Definition of Typic Natrustalfs. Add the following:

"6. If neither irrigated nor fallowed to store moisture, have *either*:

a. A frigid temperature regime, and a moisture control section which, in 6 or more years out of 10 years, is dry in all parts for less than four-tenths of the cumulative days per year when the soil temperature at a depth of 50 cm below the soil surface is higher than 5°C; *or*

b. A mesic or thermic soil temperature regime, *and* a moisture control section which, in 6 or more out of 10 years, is dry in some part for less than six tenths of the cumulative days per year when the soil temperature at a depth of 50 cm below the soil surface is higher than 5°C; *or*

c. A hyperthermic, an isomesic, or a warmer *iso* soil temperature regime, *and* a moisture control section which, in 6 or more out of 10 years, remains moist in some or all parts for 90 consecutive days or more per year when the temperature at a depth of 50 cm below the soil surface is higher than 8°C;

7. An exchangeable sodium percentage of 15 or more (or a sodium adsorption ratio of 13 or more) in more than 50 percent of the natric horizon;

8. Do not have visible crystals of gypsum or other salts more soluble than gypsum or both within 40 cm of the mineral soil surface."

Page 143, NSTH 615.62, p. 615-233; item ICFI. (Arenic Aridic Paleustalfs) (changed to ICFL.); Add new item 2.a. as follows and renumber items 2.a. and 2.b. as 2.b. and 2.c.:

"a. A frigid temperature regime, and a moisture control section which, in 6 or more out of 10 years, is dry in all parts for four-tenths or more of the cumulative days per year when the soil temperature at a depth of 50 cm below the soil surface is higher than 5°C; *or*"

Page 143, NSTH 615.62 p. 615-233; item ICFK. (Calciorthidic Paleustalfs) (changed to ICFN. Calcidic Paleustalfs); Add new item 1.a. as follows and renumber items 1.a. and 1.b. as 1.b. and 1.c.:

"a. A frigid temperature regime, and a moisture control section which, in 6 or more years out of 10 years, is dry in all parts for four-tenths or more of the cumulative days per year when the soil temperature at a depth of 50 cm below the soil surface is higher than 5°C; *or*"

Page 143, NSTH 615.62 p. 615-233; item ICFL. (Aridic Paleustalfs) (changed to ICFO. Aridic Paleustalfs); Add new item 1. as follows and renumber items 1. and 2. as 2. and 3.:

"1. A frigid temperature regime, and a moisture control section which, in 6 or more years out of 10 years, is dry in all parts for four-tenths or more of the cumulative days per year when the soil temperature at a depth of 50 cm below the soil surface is higher than 5°C; *or*"

NSTH 615.62, p. 615-234, Definition of Typic Paleustalfs; Add new item 8.a. as follows, renumber items 8.a. and 8.b. as items 8.b. and 8.c., and renumber items 8.d., 9., 10., and 11., as 9., 10., 11., and 12.:

"a. A frigid temperature regime, and a moisture control section which, in 6 or more years out of 10 years, is dry in all parts for less than four-tenths or more of the cumulative days per year when the soil temperature at a depth of 50 cm below the soil surface is higher than 5°C; *or*"

615.146 Palexeralfs

Page 147, column 1 item IDF.; Change to read:

"IDF. Other Xeralfs which have *one or more* of the following:

1. A petrocalcic horizon that has its upper boundary within 150 cm of the mineral soil surface; *or*

2. No densic, lithic, or paralithic contact within 150 cm of the mineral soil surface, *and* an argillic horizon which has *both*:

a. Within 150 cm of the mineral soil surface, *either*

(1) No clay decrease, with increasing depth, of 20 percent or more (relative) from the maximum clay content; *or*

(2) Five percent or more (by volume) skeletans on faces of peds in the layer that has a 20 percent lower clay content *and*, below that layer, a clay increase of 3 percent or more (absolute) in the fine-earth fraction; *and*

b. A base at a depth of 150 cm or more; *or*

3. No densic, lithic, nor paralithic contact within 50 cm of the mineral soil surface *and* an argillic horizon which has within 15 cm of its upper boundary: *both*

a. A clayey or clayey-skeletal particle-size class; *and*

b. A clay increase, in the fine-earth fraction, of either 20 percent or more (absolute) within a vertical distance of 7.5 cm, *or* of 15 percent or more (absolute) within a vertical distance of 2.5 cm.

Palexeralfs"

Page 151, Definition of Palexeralfs (refer to NSTH 615.11, p. 615-19); Replace entire definition with the following:

"Palexeralfs are the Xeralfs that have one of the following:

1. A petrocalcic horizon that has its upper boundary within 150 cm of the mineral soil surface; *or*

2. No densic, lithic, nor paralithic contact within 150 cm of the mineral soil surface, *and* an argillic horizon which has *both*:

a. Within 150 cm of the mineral soil surface, *either*

(1) No clay decrease, with increasing depth, of 20 percent or more (relative) from the maximum clay content; *or*

(2) Five percent or more (by volume) skeletans on faces of peds in the layer that has a 20 percent lower clay content *and*, below that layer, a clay increase of 3 percent or more (absolute) in the fine-earth fraction; *and*

b. Its base at a depth of 150 cm or more; *or*

3. No densic, lithic, nor paralithic contact within 50 cm of the mineral soil surface *and* an argillic horizon which has within 15 cm of its upper boundary: *both*

a. A clayey or clayey-skeletal particle-size class; *and*

b. A clay increase, in the fine-earth fraction, of either 20 percent or more (absolute) within a vertical distance of 7.5 cm, *or* of 15 percent or more (absolute) within a vertical distance of 2.5 cm."

615.147 "Fulvi" great groups of Andisols

NSTH 615.60 p. 615-185; Change item BBC. (changed to CBC.) as follows:

"CBC. Other Cryands which have a layer that meets the depth, thickness, and organic-carbon requirements of a melanic epipedon.

Fulvicryands"

NSTH 615.60, p. 615-185, definition of Fulvicryands; Change item 2. to read as follows:

"2. Do not have a melanic epipedon, but have a layer that meets the depth, thickness, and organic-carbon requirements of a melanic epipedon."

NSTH 615.60, p. 615-185. Change item BGD. (changed to CGD.) as follows:

"CGD. Other Udands which have a layer that meets the depth, thickness, and organic-carbon requirements of a melanic epipedon.

Fulvudands"

NSTH 615.60, p. 615-190, definition of Fulvudands; Change item 3. to read as follows:

"3. Do not have a melanic epipedon, but have a layer that meets the depth, thickness, and organic-carbon requirements of a melanic epipedon."

615.148 Rhodic great groups and subgroups

Page 125, item HEH. (changed to IEJ.). Delete entire item and replace with the following:

"IEJ. Other Udalfs that have in *all* horizons in the upper 100 cm of the argillic horizon or throughout the entire argillic horizon, if less than 100 cm thick, more than 50 percent colors that have *all* of the following:

1. A hue of 2.5YR or redder; *and*

2. A value moist of 3 or less; *and*

3. A value dry no more than 1 unit higher than the value moist.

Rhodudalfs"

Page 136. After the description of Rhodudalfs, add the following definition:

"**Definition**
Rhodudalfs are the Udalfs that

1. Have in *all* horizons in the upper 100 cm of the argillic horizon or throughout the entire argillic horizon, if less than 100 cm thick, more than 50 percent colors that have *all* of the following:

a. A hue of 2.5YR or redder; *and*

b. A value moist of 3 or less; *and*

c. A value dry no more than 1 unit higher than the value moist;

2. Do not have any of the following horizons: an agric, a glossic, a kandic, a natric, nor a fragipan;

3. Do not have the following combination of characteristics:

a. A discontinuous albic horizon, or no albic horizon, above the argillic horizon; and

b. An argillic horizon that is discontinuous horizontally; and

c. In the argillic horizon, discrete nodules 2.5 cm to 30 cm in diameter with exteriors that (a) are enriched and either weakly cemented to indurated with iron, and (b) have either a redder hue or a higher chroma than the interiors;

4. Have a densic, lithic, or paralithic contact within 150 cm of the soil surface; or

a. Within 150 cm of the mineral soil surface, have both:

(1) A clay decrease with increasing depth of 20 percent or more (relative) from the maximum clay content; and

(2) Less than 5 percent (by volume) skeletans on faces of peds in the layer that has a 20 percent lower clay content or, below that layer, a clay increase of less than 3 percent (absolute) in the fine-earth fraction."

Page 138 item HCE. (changed to ICG.). Delete entire item and replace with the following:

"ICG. Other Ustalfs that have in *all* horizons in the upper 100 cm of the argillic horizon or throughout the entire argillic horizon, if less than 100 cm thick, more than 50 percent colors that have *all* of the following:

1. A hue of 2.5YR or redder; *and*

2. A value moist of 3 or less; *and*

3. A value dry no more than 1 unit higher than the value moist.

Rhodustalfs"

Page 145, Definition of Rhodustalfs. Change item 1. to read as follows:

"1. Have in *all* horizons in the upper 100 cm of the argillic horizon or throughout the entire argillic horizon, if less than 100 cm thick, more than 50 percent colors that have *all* of the following:

a. A hue of 2.5YR or redder; *and*

b. A value moist of 3 or less; *and*

c. A value dry no more than 1 unit higher than the value moist."

Page 147 item HDD. (changed to IDE.). Delete entire item and replace with the following:

"IDE. Other Xeralfs that have in *all* horizons in the upper 100 cm of the argillic horizon or throughout the entire argillic horizon, if less than 100 cm thick, more than 50 percent colors that have *all* of the following:

1. A hue of 2.5YR or redder; *and*

2. A value moist of 3 or less; *and*

3. A value dry no more than 1 unit higher than the value moist.

Rhodoxeralfs"

Page 153, Definition of Rhodoxeralfs. Replace with the following:

"**Definition**

Rhodoxeralfs are the Xeralfs that

1. Have in *all* horizons in the upper 100 cm of the argillic horizon or throughout the entire argillic horizon, if less than 100 cm thick, more than 50 percent colors that have *all* of the following:

a. A hue of 2.5YR or redder; *and*

b. A value moist of 3 or less; *and*

c. A value dry no more than 1 unit higher than the value moist;

2. Do not have a duripan that has its upper boundary within 100 cm of the mineral soil surface;

3. Do not have a fragipan or a natric horizon;

4. Do not have within 150 cm of the mineral soil surface plinthite forming a continuous phase or constituting one half or more of the volume."

Rhodic Subgroups of Alfisols:

NSTH 615.62, p. 615-225, item IEGH. (change to IEGI., Rhodic Kandiudalfs). Replace with the following:

"IEGI. Other Kandiudalfs that have in *all* horizons in the upper 100 cm of the argillic or kandic horizon or throughout the entire argillic or kandic horizon, if less than 100 cm thick, more than 50 percent colors that have *all* of the following:

1. A hue of 2.5YR or redder; *and*

2. A value moist of 3 or less; *and*

3. A value dry no more than 1 unit higher than the value moist.

Rhodic Kandiudalfs"

NSTH 615.62, p. 615-225, Definition of Typic Kandiudalfs. Change item 4. to read as follows:

"4. Do not have in *all* horizons in the upper 100 cm of the argillic or kandic horizon or throughout the entire argillic or kandic horizon, if less than 100 cm thick, more than 50 percent colors that have *all* of the following:

a. A hue of 2.5YR or redder; *and*

b. A value moist of 3 or less; *and*

c. A value dry no more than 1 unit higher than the value moist."

NSTH 615.62, p. 615-225, item IEHC. (change to IEHD., Rhodic Kanhapludalfs). Replace with the following:

"IEHD. Other Kanhapludalfs that have in *all* horizons in the upper 100 cm of the argillic or kandic horizon or throughout the entire argillic or kandic horizon, if less than 100 cm thick, more than 50 percent colors that have *all* of the following:

1. A hue of 2.5YR or redder; *and*

2. A value moist of 3 or less; *and*

3. A value dry no more than 1 unit higher than the value moist.

Rhodic Kanhapludalfs"

NSTH 615.62, p. 615-226, Definition of Typic Kanhapludalfs. Change item 3. to read as follows:

"3. Have in *all* horizons in the upper 100 cm of the argillic or kandic horizon or throughout the entire argillic or kandic horizon, if less than 100 cm thick, 50 percent or less colors that have *all* of the following:

a. A hue of 2.5YR or redder; *and*

b. A value moist of 3 or less; *and*

c. A value dry no more than 1 unit higher than the value moist."

Page 134 and NSTH 615.62 p. 615-227, item IEIM. (Changed to IEIO., Rhodic Paleudalfs). Replace with the following:

"IEIO. Other Paleudalfs that have in *all* horizons in the upper 100 cm of the argillic

horizon or throughout the entire argillic horizon, if less than 100 cm thick, more than 50 percent colors that have *all* of the following:

1. A hue of 2.5YR or redder; *and*

2. A value moist of 3 or less; *and*

3. A value dry no more than 1 unit higher than the value moist.

Rhodic Paleudalfs"

NSTH 615.62, p. 615-228, Definition of Typic Paleudalfs. Change item 4. to read as follows:

"4. Do not have in *all* horizons in the upper 100 cm of the argillic horizon or throughout the entire argillic horizon, if less than 100 cm thick, more than 50 percent colors that have *all* of the following:

a. A hue of 2.5YR or redder; *and*

b. A value moist of 3 or less; *and*

c. A value dry no more than 1 unit higher than the value moist."

NSTH 615.62, p. 615-231, item ICDI. (Rhodic Kandiustalfs), Replace with the following:

"ICDI. Other Kandiustalfs that have in *all* horizons in the upper 100 cm of the argillic or kandic horizon or throughout the entire argillic or kandic horizon, if less than 100 cm thick, more than 50 percent colors that have *all* of the following:

1. A hue of 2.5YR or redder; *and*

2. A value moist of 3 or less; *and*

3. A value dry no more than 1 unit higher than the value moist.

Rhodic Kandiustalfs"

NSTH 615.62, p. 615-231, Definition of Typic Kandiustalfs. Change item 6. to read as follows:

"6. Do not have in *all* horizons in the upper 100 cm of the argillic or kandic horizon or throughout the entire argillic or kandic horizon, if less than 100 cm thick, more than 50 percent colors that have *all* of the following:

a. A hue of 2.5YR or redder; *and*

b. A value moist of 3 or less; *and*

c. A value dry no more than 1 unit higher than the value moist."

NSTH 615.62, p. 615-232, item ICEE. (Rhodic Kanhaplustalfs). Replace with the following:

"ICEE. Other Kanhaplustalfs that have in *all* horizons in the upper 100 cm of the argillic or kandic horizon or throughout the entire argillic or kandic horizon, if less than 100 cm thick, more than 50 percent colors that have *all* of the following:

1. A hue of 2.5YR or redder; *and*

2. A value moist of 3 or less; *and*

3. A value dry no more than 1 unit higher than the value moist.

Rhodic Kanhaplustalfs"

NSTH 615.62, p. 615-232, Definition of Typic Kanhaplustalfs. Change item 5. to read as follows:

"5. Do not have in *all* horizons in the upper 100 cm of the argillic or kandic horizon or throughout the entire argillic or kandic horizon, if less than 100 cm thick, more than 50 percent colors that have *all* of the following:

a. A hue of 2.5YR or redder; *and*

b. A value moist of 3 or less; *and*

c. A value dry no more than 1 unit higher than the value moist."

Page 143 and NSTH 615.62, p. 615-234, item ICFN. (Changed to ICFQ.), (Rhodic Paleustalfs); Replace with the following:

"ICFQ. Other Paleustalfs that have in *all* horizons in the upper 100 cm of the argillic horizon or throughout the entire argillic horizon, if less than 100 cm thick, more than 50 percent colors that have *all* of the following:

1. A hue of 2.5YR or redder; *and*

2. A value moist of 3 or less; *and*

3. A value dry no more than 1 unit higher than the value moist.

Rhodic Paleustalfs"

NSTH 615.62, p. 615-235, Definition of Typic Paleustalfs. Change item 10. to read as follows:

"10. Do not have in *all* horizons in the upper 100 cm of the argillic horizon or throughout the entire argillic horizon, if less than 100 cm thick, more than 50 percent colors that have *all* of the following:

a. A hue of 2.5YR or redder; *and*

b. A value moist of 3 or less; *and*

c. A value dry no more than 1 unit higher than the value moist."

NSTH 615.45, p. 615-129, item CDBH. (changed to DDBH., Humic Rhodic Acroperox); Replace item 2. with the following:

"2. In *all* horizons between 25 and 125 cm from the mineral soil surface, more than 50 percent colors that have *both* of the following:

a. A hue of 2.5YR or redder; *and*

b. A value moist of 3 or less.

Humic Rhodic Acroperox"

NSTH 615.45, p. 615-129, item CDBK. (changed to DDBK., Rhodic Acroperox); Replace with the following:

"CDBK. Other Acroperox that have in *all* horizons between 25 and 125 cm from the mineral soil surface, more than 50 percent colors that have *both* of the following:

1. A hue of 2.5YR or redder; *and*

2. A value moist of 3 or less.

Rhodic Acroperox"

NSTH 615.62, p. 615-353, Definition of Typic Acroperox; Delete the word "have", add a ":" at the end of the first line, and change item 6. to read as follows:

"6. Have in some horizon between 25 and 125 cm from the mineral soil surface, 50 percent or less colors that have *both* of the following:

1. A hue of 2.5YR or redder; *and*

2. A value moist of 3 or less."

NSTH 615.45, p. 615-131, item CDCK. (changed to DDCK., Humic Rhodic Eutroperox); Replace item 2. with the following:

"2. In *all* horizons between 25 and 125 cm from the mineral soil surface, more than 50 percent colors that have *both* of the following:

a. A hue of 2.5YR or redder; *and*

b. A value moist of 3 or less.

Humic Rhodic Eutroperox"

NSTH 615.45, p. 615-129, item CDCN. (changed to DDCN., Rhodic Eutroperox); Replace with the following:

"DDCN. Other Eutroperox that have in *all* horizons between 25 and 125 cm from the mineral soil surface, more than 50 percent colors that have *both* of the following:

1. A hue of 2.5YR or redder; *and*

2. A value moist of 3 or less.

Rhodic Eutroperox"

NSTH 615.62, p. 615-353, Definition of Typic Eutroperox. Add a ":" at the end of the first line and change item 7. to read as follows:

"7. Have in some horizon between 25 and 125 cm from the mineral soil surface, 50 percent or less colors that have *both* of the following:

a. A hue of 2.5YR or redder; *and*

b. A value moist of 3 or less."

NSTH 615.45, p. 615-133, item CDEI. (changed to DDEI., Humic Rhodic Haploperox); Replace item 2. with the following:

"2. In *all* horizons between 25 and 125 cm from the mineral soil surface, more than 50 percent colors that have *both* of the following:

a. A hue of 2.5YR or redder; *and*

b. A value moist of 3 or less.

Humic Rhodic Haploperox"

NSTH 615.45, p. 615-133, item CDEL. (changed to DDEL., Rhodic Haploperox); Replace with the following:

"DDEL. Other Haploperox that have in *all* horizons between 25 and 125 cm from the mineral soil surface, more than 50 percent colors that have *both* of the following:

1. A hue of 2.5YR or redder; *and*

2. A value moist of 3 or less.

Rhodic Haploperox"

NSTH 615.62, p. 615-352, Definition of Typic Haploperox; Add a ":" at the end of the first line and change item 6. to read as follows:

"6. Have in some horizon between 25 and 125 cm from the mineral soil surface, 50 percent or less colors that have *both* of the following:

a. A hue of 2.5YR or redder; *and*

b. A value moist of 3 or less."

NSTH 615.45, p. 615-135, item CDDI. (changed to DDDI., Humic Rhodic Kandiperox); Replace item 2. with the following:

"2. In *all* horizons between 25 and 125 cm from the mineral soil surface, more than 50 percent colors that have *both* of the following:

a. A hue of 2.5YR or redder; *and*

b. A value moist of 3 or less.

Humic Rhodic Kandiperox"

NSTH 615.45, p. 615-135, item CDDL. (changed to DDDL.) (Rhodic Kandiperox); Replace with the following:

"DDDL. Other Kandiperox that have in *all* horizons between 25 and 125 cm from the mineral soil surface, more than 50 percent colors that have *both* of the following:

1. A hue of 2.5YR or redder; *and*

2. A value moist of 3 or less.

Rhodic Kandiperox"

NSTH 615.62, p. 615-353 and 354, Definition of Typic Haploperox. Add a ":" at the end of the first line and change item 6. to read as follows:

"6. Have in some horizon between 25 and 125 cm from the mineral soil surface, 50 percent or less colors that have *both* of the following:

a. A hue of 2.5YR or redder; *and*

b. A value moist of 3 or less."

NSTH 615.45, p. 615-140, item CEBJ. (changed to DEBJ., Humic Rhodic Acrudox). Replace item 2. with the following:

"2. In *all* horizons between 25 and 125 cm from the mineral soil surface, more than 50 percent colors that have *both* of the following:

a. A hue of 2.5YR or redder; *and*

b. A value moist of 3 or less.

Humic Rhodic Acrudox"

NSTH 615.45, p. 615-140, item CEBM. (changed to DEBM., Rhodic Acrudox). Replace with the following:

"DEBM. Other Acrudox that have in *all* horizons between 25 and 125 cm from the mineral soil surface, more than 50 percent colors that have *both* of the following:

1. A hue of 2.5YR or redder; *and*

2. A value moist of 3 or less.

Rhodic Acrudox"

NSTH 615.62, p. 615-354, Definition of Typic Acrudox. Add a ":" at the end of the first line and change item 7. to read as follows:

"7. Have in some horizon between 25 and 125 cm from the mineral soil surface, 50 percent or less colors that have *both* of the following:

a. A hue of 2.5YR or redder; *and*

b. A value moist of 3 or less."

NSTH 615.45, p. 615-142, item CECK. (changed to DECK., Humic Rhodic Eutrudox); Replace item 2. with the following:

"2. In *all* horizons between 25 and 125 cm from the mineral soil surface, more than 50 percent colors that have *both* of the following:

a. A hue of 2.5YR or redder; *and*

b. A value moist of 3 or less.

Humic Rhodic Eutrudox"

NSTH 615.45, p. 615-142, item CECN. (changed to DECN., Rhodic Eutrudox); Replace with the following:

"DECN. Other Acrudox that have in *all* horizons between 25 and 125 cm from the mineral soil surface, more than 50 percent colors that have *both* of the following:

1. A hue of 2.5YR or redder; *and*

2. A value moist of 3 or less.
Rhodic Eutrudox"

NSTH 615.62, p. 615-354, Definition of Typic Eutrudox. Add a ":" at the end of the first line and change item 7. to read as follows:

"7. Have in some horizon between 25 and 125 cm from the mineral soil surface, 50 percent or less colors that have *both* of the following:

a. A hue of 2.5YR or redder; *and*

b. A value moist of 3 or less."

NSTH 615.45, p. 615-144, item CEEJ. (changed to DEEJ. Humic Rhodic Hapludox); Replace item 2. with the following:

"2. In *all* horizons between 25 and 125 cm from the mineral soil surface, more than 50 percent colors that have *both* of the following:

a. A hue of 2.5YR or redder; *and*

b. A value moist of 3 or less.
Humic Rhodic Hapludox"

NSTH 615.45, p. 615-144, item CEEM. (changed to DEEM., Rhodic Hapludox). Replace with the following:

"DEEM. Other Hapludox that have in *all* horizons between 25 and 125 cm from the mineral soil surface, more than 50 percent colors that have *both* of the following:

1. A hue of 2.5YR or redder; *and*

2. A value moist of 3 or less.
Rhodic Hapludox"

NSTH 615.62, p. 615-355, Definition of Typic Hapludox; Add a ":" at the end of the first line and change item 7. to read as follows:

"7. Have in some horizon between 25 and 125 cm from the mineral soil surface, 50 percent or less colors that have *both* of the following:

a. A hue of 2.5YR or redder; *and*

b. A value moist of 3 or less."

NSTH 615.45, p. 615-146, item CEDI. (changed to DEDI. Humic Rhodic Kandiudox); Replace item 2. with the following:

"2. In *all* horizons between 25 and 125 cm from the mineral soil surface, more than 50 percent colors that have *both* of the following:

a. A hue of 2.5YR or redder; *and*

b. A value moist of 3 or less.
Humic Rhodic Kandiudox"

NSTH 615.45, p. 615-146, item CEDL. (changed to DEDL. Rhodic Kandiudox); Replace with the following:

"DEDL. Other Kandiudox that have in *all* horizons between 25 and 125 cm from the mineral soil surface, more than 50 percent colors that have *both* of the following:

1. A hue of 2.5YR or redder; *and*

2. A value moist of 3 or less.
Rhodic Kandiudox"

NSTH 615.62, p. 615-355, Definition of Typic Kandiudox; Add a ":" at the end of the first line and change item 6. to read as follows:

"6. Have in some horizon between 25 and 125 cm from the mineral soil surface, 50 percent or less colors that have *both* of the following:

a. A hue of 2.5YR or redder; *and*

b. A value moist of 3 or less."

NSTH 615.45, p. 615-149, item CCBJ. (changed to DCBJ. Humic Rhodic Acrustox); Replace item 2. with the following:

"2. In *all* horizons between 25 and 125 cm from the mineral soil surface, more than 50 percent colors that have *both* of the following:

a. A hue of 2.5YR or redder; *and*

b. A value moist of 3 or less.
Humic Rhodic Acrustox"

NSTH 615.45, p. 615-149, item CCBM. (changed to DCBM. Rhodic Acrustox); Replace with the following:

"DCBM. Other Acrustox that have in *all* horizons between 25 and 125 cm from the mineral soil surface, more than 50 percent colors that have *both* of the following:

1. A hue of 2.5YR or redder; *and*

2. A value moist of 3 or less.
Rhodic Acrustox"

NSTH 615.62, p. 615-355 and 356, Definition of Typic Acrustox; Add a ":" at the end of the first line and change item 7. to read as follows:

"7. Have in some horizon between 25 and 125 cm from the mineral soil surface, 50 percent or less colors that have *both* of the following:

a. A hue of 2.5YR or redder; *and*

b. A value moist of 3 or less."

NSTH 615.45, p. 615-151, item CCCK. (changed to DCCK. Humic Rhodic Eutrustox). Replace item 2. with the following:

"2. In *all* horizons between 25 and 125 cm from the mineral soil surface, more than 50 percent colors that have *both* of the following:

a. A hue of 2.5YR or redder; *and*

b. A value moist of 3 or less.
Humic Rhodic Eutrustox"

NSTH 615.45, p. 615-152, item CCCN. (changed to DCCN. Rhodic Eutrustox); Replace with the following:

"DCCN. Other Eutrustox that have in *all* horizons between 25 and 125 cm from the mineral soil surface, more than 50 percent colors that have *both* of the following:

1. A hue of 2.5YR or redder; *and*

2. A value moist of 3 or less.
Rhodic Eutrustox"

NSTH 615.62, p. 615-356, Definition of Typic Eutrustox; Add a ":" at the end of the first line and change item 7. to read as follows:

"7. Have in some horizon between 25 and 125 cm from the mineral soil surface, 50 percent or less colors that have *both* of the following:

a. A hue of 2.5YR or redder; *and*

b. A value moist of 3 or less."

NSTH 615.45, p. 615-153, item CCEJ. (changed to DCEK. Humic Rhodic Haplustox); Replace item 2. with the following:

"2. In *all* horizons between 25 and 125 cm from the mineral soil surface, more than 50 percent colors that have *both* of the following:

a. A hue of 2.5YR or redder; *and*

b. A value moist of 3 or less.

Humic Rhodic Haplustox"

NSTH 615.45, p. 615-154, item CCEM. (changed to DCEN. Rhodic Haplustox); Replace with the following:

"DCEN. Other Haplustox that have in *all* horizons between 25 and 125 cm from the mineral soil surface, more than 50 percent colors that have *both* of the following:

1. A hue of 2.5YR or redder; *and*

2. A value moist of 3 or less.

Rhodic Haplustox"

NSTH 615.62, p. 615-356, Definition of Typic Haplustox; Add a ":" at the end of the first line and change item 6. to read as follows:

"6. Have in some horizon between 25 and 125 cm from the mineral soil surface, 50 percent or less colors that have *both* of the following:

a. A hue of 2.5YR or redder; *and*

b. A value moist of 3 or less."

NSTH 615.45, p. 615-155, item CCDH. (changed to DCDH. Humic Rhodic Kandiustox); Replace item 2. with the following:

"2. In *all* horizons between 25 and 125 cm from the mineral soil surface, more than 50 percent colors that have *both* of the following:

a. A hue of 2.5YR or redder; *and*

b. A value moist of 3 or less.

Humic Rhodic Kandiustox"

NSTH 615.45, p. 615-155, item CCDK. (changed to DCDK. Rhodic Kandiustox); Replace item 2. with the following:

"DCDK. Other Kandiustox that have in *all* horizons between 25 and 125 cm from the mineral soil surface, more than 50 percent colors that have *both* of the following:

1. A hue of 2.5YR or redder; *and*

2. A value moist of 3 or less.

Rhodic Kandiustox"

NSTH 615.62, p. 615-356, Definition of Typic Kandiustox; Add a ":" at the end of the first line and change item 5. to read as follows:

"5. Have in some horizon between 25 and 125 cm from the mineral soil surface, 50 percent or less colors that have *both* of the following:

a. A hue of 2.5YR or redder; *and*

b. A value moist of 3 or less."

Page 360, item FCD. (Changed to GCF.); Replace criteria with the following:

"GCF. Other Udults which have *both*:

1. An epipedon that has a color value, moist, of 3 or less throughout; *and*

2. In *all* horizons in the upper 100 cm of the argillic horizon or throughout the entire argillic horizon, if less than 100 cm thick, more than 50 percent colors that have *all* of the following:

a. A hue of 2.5YR or redder; *and*

b. A value moist of 3 or less; *and*

c. A value dry no more than 1 unit higher than the value moist.

Rhodudults"

Page 369, item FDC. (Changed to GDE.); Replace with the following:

"GDE. Other Ustults which have *both*:

1. An epipedon that has a color value, moist, of 3 or less throughout; *and*

2. In *all* horizons in the upper 100 cm of the argillic horizon or throughout the entire argillic horizon, if less than 100 cm thick, more than 50 percent colors that have *all* of the following:

a. A hue of 2.5YR or redder; *and*

b. A value moist of 3 or less; *and*

c. A value dry no more than 1 unit higher than the value moist.

Rhodustults"

Rhodic subgroups of Ultisols:

NSTH 615.62, p. 615-373, item GCCD.2. (Arenic Rhodic Kandiudults); Replace with the following:

"2. In *all* horizons in the upper 100 cm of the argillic or kandic horizon or throughout the entire argillic or kandic horizon, if less than 100 cm thick, more than 50 percent colors that have *all* of the following:

a. A hue of 2.5YR or redder; *and*

b. A value moist of 3 or less; *and*

c. A value dry no more than 1 unit higher than the value moist.

Arenic Rhodic Kandiudults"

NSTH 615.62, p. 615-375, item GCCQ. (Changed to GCCR. Rhodic Kandiudults); Replace with the following:

"GCCR. Other Kandiudults that have in *all* horizons in the upper 100 cm of the argillic or kandic horizon or throughout the entire argillic or kandic horizon, if less than 100 cm thick, more than 50 percent colors that have *all* of the following:

1. A hue of 2.5YR or redder; *and*

2. A value moist of 3 or less; *and*

3. A value dry no more than 1 unit higher than the value moist.

Rhodic Kandiudults"

NSTH 615.62, p. 615-375, Definition of Typic Kandiudults; Add a ":" at the end of the first line and change item 4. to read as follows:

"4. Have in some or all parts of the upper 100 cm of the argillic or kandic horizon, 50 percent or less colors that have *all* of the following:

a. A hue of 2.5YR or redder; *and*

b. A value moist of 3 or less; *and*

c. A value dry no more than 1 unit higher than the value moist."

NSTH 615.62, p. 615-376, item GCDJ. (Changed to GCDK. Rhodic Kanhapludults); Replace with the following:

"GCDK. Other Kanhapludults that have in *all* horizons in the upper 100 cm of the argillic or kandic horizon or throughout the entire argillic or kandic horizon, if less than 100 cm thick, more than 50 percent colors that have *all* of the following:

1. A hue of 2.5YR or redder; *and*

2. A value moist of 3 or less; *and*

3. A value dry no more than 1 unit higher than the value moist.

Rhodic Kanhapludults"

NSTH 615.62, p. 615-375, Definition of Typic Kanhapludults. Add a ":" at the end of the first line and change item 6. to read as follows:

"6. Have in some or all parts of the upper 100 cm of the argillic or kandic horizon, 50 percent or less colors that have *all* of the following:

a. A hue of 2.5YR or redder; *and*

b. A value moist of 3 or less; *and*

c. A value dry no more than 1 unit higher than the value moist."

Page 364 and NSTH 615.62, p. 615-377, item GCEG. (Changed to GCEH. Arenic Rhodic Paleudults), Replace item 2. with the following:

"2. In *all* horizons in the upper 100 cm of the argillic horizon or throughout the entire argillic horizon, if less than 100 cm thick, more than 50 percent colors that have *all* of the following:

a. A hue of 2.5YR or redder; *and*

b. A value moist of 3 or less; *and*

c. A value dry no more than 1 unit higher than the value moist.

Arenic Rhodic Paleudults"

Page 365 and NSTH 615.62, p. 615-378, item GCEP. (changed to GCER., Rhodic Paleudults); Replace with the following:

"GCER. Other Paleudults that have in *all* horizons in the upper 100 cm of the argillic horizon or throughout the entire argillic horizon, if less than 100 cm thick, more than 50 percent colors that have *all* of the following:

1. A hue of 2.5YR or redder; *and*

2. A value moist of 3 or less; *and*

3. A value dry no more than 1 unit higher than the value moist.

Rhodic Paleudults"

NSTH 615.62, p. 615-378, Definition of Typic Paleudults; Add a ":" at the end of the first line and change item 4. to read as follows:

"4. Have in some or all parts of the upper 100 cm of the argillic horizon, 50 percent or less colors that have *all* of the following:

a. A hue of 2.5YR or redder; *and*

b. A value moist of 3 or less; *and*

c. A value dry no more than 1 unit higher than the value moist."

NSTH 615.62, p. 615-381, item GDBJ., (Rhodic Kandiustults); Replace with the following:

"GDBJ. Other Kandiustults that have in *all* horizons in the upper 100 cm of the argillic or kandic horizon or throughout the entire argillic or kandic horizon, if less than 100 cm thick, more than 50 percent colors that have *all* of the following:

1. A hue of 2.5YR or redder; *and*

2. A value moist of 3 or less; *and*

3. A value dry no more than 1 unit higher than the value moist.

Rhodic Kandiustults"

NSTH 615.62, p. 615-381, Definition of Typic Kandiustults; Add a ":" at the end of the first line and change item 4. to read as follows:

"4. Have in some or all parts of the upper 100 cm of the argillic or kandic horizon, 50 percent or less colors that have *all* of the following:

a. A hue of 2.5YR or redder; *and*

b. A value moist of 3 or less; *and*

c. A value dry no more than 1 unit higher than the value moist."

NSTH 615.62, p. 615-382, item GDCK. (Rhodic Kanhaplustults); Replace with the following:

"GDCK. Other Kanhaplustults that have in *all* horizons in the upper 100 cm of the argillic horizon or kandic or throughout the entire argillic or kandic horizon, if less than 100 cm thick, more than 50 percent colors that have *all* of the following:

1. A hue of 2.5YR or redder; *and*

2. A value moist of 3 or less; *and*

3. A value dry no more than 1 unit higher than the value moist.

Rhodic Kanhaplustults"

NSTH 615.62, p. 615-382, Definition of Typic Kanhaplustults; Add a ":" at the end of the first line and change item 6. to read as follows:

"6. Have in some or all parts of the upper 100 cm of the argillic or kandic horizon, 50 percent or less colors that have *all* of the following:

a. A hue of 2.5YR or redder; *and*

b. A value moist of 3 or less; *and*

c. A value dry no more than 1 unit higher than the value moist."

615.149 Vertic and combination "Vertic" subgroups of Fluvents

NSTH 615.62, p. 615-269, renumber items KDFA. through KDFF. as KDFC. through KDFH. and add the following:

"KDFA. Udifluvents which have both:

1. One or both of the following:

a. Cracks within 125 cm of the mineral soil surface that are 5 mm or more wide through a thickness of 30 cm or more for some time in most years, and slickensides or wedge-shaped aggregates in a layer 15 cm or more thick that has its upper boundary within 125 cm of the mineral soil surface; *or*

b. A linear extensibility of 6.0 or more between the mineral soil surface and either a depth of 100 cm or a densic, lithic, or paralithic contact, whichever is shallower; *and*

2. *Either* or both of the following:

a. In one or more horizons within 50 cm of the mineral soil surface, redox depletions with a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage); *or*

b. In one or more horizons within 100 cm of the mineral soil surface, a color value, moist, of 4 or more and either a chroma of 0 or a hue of 5GY, 5G, 5BG, or 5B, and also aquic conditions for some time in most years (or artificial drainage).

Aquertic Udifluvents

KDFB. Other Udifluvents which have one or both of the following:

1. Cracks within 125 cm of the mineral soil surface that are 5 mm or more wide through a thickness of 30 cm or more for some time in most years, and slickensides or wedge-shaped aggregates in a layer 15 cm or more thick that has its upper boundary within 125 cm of the mineral soil surface; *or*

2. A linear extensibility of 6.0 or more between the mineral soil surface and either a depth of 100 cm or a densic, lithic, or paralithic contact, whichever is shallower.

Vertic Udifluvents"

NSTH 615.89, p. 615-466, add the following to the definition of Typic Udifluvents:

"5. Do not have either of the following:

a. Cracks within 125 cm of the mineral soil surface that are 5 mm or more wide through a thickness of 30 cm or more for some time in most years, and slickensides or wedge-shaped aggregates in a layer 15 cm or more thick that has its upper boundary within 125 cm of the mineral soil surface; *or*

b. A linear extensibility of 6.0 or more between the mineral soil surface and either a depth of 100 cm or a densic, lithic, or paralithic contact, whichever is shallower."

Page 192 and NSTH 615.62, p. 615-270. Before item KDCA. (Vertic Ustifluvents) add the following and renumber items KDCA. through KDCH. as KDCC. through KDCJ.:

"KDCA. Ustifluvents which have both:

1. One or both of the following:

a. Cracks within 125 cm of the mineral soil surface that are 5 mm or more wide through a thickness of 30 cm or more for some time in most years, and slickensides or wedge-shaped aggregates in a layer 15 cm or more thick that has its upper boundary within 125 cm of the mineral soil surface; *or*

b. A linear extensibility of 6.0 or more between the mineral soil surface and either a depth of 100 cm or a densic, lithic, or paralithic contact, whichever is shallower; *and*

2. Either or both of the following:

a. In one or more horizons within 50 cm of the mineral soil surface, redox depletions with a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage); *or*

b. In one or more horizons within 150 cm of the mineral soil surface, a color value, moist, of 4 or more and either a chroma of 0 or a hue of 5GY, 5G, 5BG, or 5B, and also aquic conditions for some time in most years (or artificial drainage).

Aquertic Ustifluvents

KDCB. Other Ustifluvents that have *both* of the following:

1. If neither irrigated nor fallowed to store moisture, have *either*:

a. A frigid temperature regime, and a moisture control section which, in 6 or more years out of 10 years, is dry in all parts for four-tenths or more of the cumulative days per year when the soil temperature at a depth of 50 cm below the soil

surface is higher than 5°C; *or*

b. A mesic or thermic soil temperature regime, *and* a moisture control section which, in 6 or more out of 10 years, is dry in some part for six tenths or more of the cumulative days per year when the soil temperature at a depth of 50 cm below the soil surface is higher than 5°C; *or*

c. A hyperthermic, an isomesic, or a warmer *iso* soil temperature regime, *and* a moisture control section which, in 6 or more out of 10 years, remains moist in some or all parts for less than 90 consecutive days per year when the temperature at a depth of 50 cm below the soil surface is higher than 8°C; *and*

2. *One or both* of the following:

a. Cracks within 125 cm of the mineral soil surface that are 5 mm or more wide through a thickness of 30 cm or more for some time in most years, and slickensides or wedge-shaped aggregates in a layer 15 cm or more thick that has its upper boundary within 125 cm of the mineral soil surface; *or*

b. A linear extensibility of 6.0 cm or more between the mineral soil surface and either a depth of 100 cm or a densic, lithic, or paralithic contact, whichever is shallower.

Torrertic Ustifluvents"

615.150 Aridic Lithic and Gypsic subgroups of Ustochrepts

Page 225 and NSTH 615.62, p. 615-302 item JDDA. (changed to JDEA. Lithic Ustochrepts) add "Other" at the beginning, renumber as JDEB., add the following item before JDEB., and renumber items JDEB. to JDEK. as JDEC. to JDEL:

"JDEA. Ustochrepts that have:

1. A lithic contact within 50 cm of the mineral soil surface; *and*

2. If neither irrigated nor fallowed to store moisture, *one* of the following:

a. A frigid soil temperature regime, *and* a moisture control section which, in 6 or more out of 10 years, is dry in all parts for four tenths or more of the cumulative days per year when the soil temperature at a depth of 50 cm below the soil surface is higher than 5°C; *or*

b. A mesic or thermic soil temperature regime, *and* a moisture control section which, in 6 or more out of 10 years, is dry in some part for six tenths or more of the cumulative days per year when the soil temperature at a depth of 50 cm below the soil surface is higher than 5°C; *or*

c. A hyperthermic, an isomesic, or a warmer *iso* soil temperature regime, *and* a moisture control section which, in 6 or more out of 10 years, is moist in some or all parts for less than 180 cumulative days per year when the temperature at a depth of 50 cm below the soil surface is higher than 8°C.

Aridic Lithic Ustochrepts"

Page 225 and NSTH 615.62, p. 615-302. following item JDDG. (changed to JDEL. above Fluventic Ustochrepts); Add the following item and renumber items JDEL. to JDER. as JDEN. to JDET:

"JDEM. Other Ustochrepts which have a gypsic horizon that has its upper boundary within 100 cm of the mineral soil surface.

Gypsic Ustochrepts"

NSTH 615.62, p. 615-303, Definition of Typic Ustochrepts. Add a ":" at the end of the first line and add item 8. as follows:

"8. Do not have a gypsic horizon that has its upper boundary within 100 cm of the mineral soil surface."

615.151 Combination "Oxyaquic" Subgroups

NSTH 615.62, p. 615-216, following item IBEF. (changed above to IBEH. Aquic Eutroboralfs); Add items IBEI. through IBEL. as follows:

"IBEI. Other Eutroboralfs which have *both*

1. An argillic horizon that:

a. Consists entirely of lamellae; *or*

b. Is a combination of two or more lamellae and one or more subhorizons with a thickness of 7.5 to 20 cm, each layer with an overlying eluvial horizon; *or*

c. Consists of one or more subhorizons which are more than 20 cm thick, each with an overlying eluvial horizon, and above these horizons there is either:

(1) Two or more lamellae with a combined thickness of 5 cm or more (that may or may not be part of the argillic horizon); *or*

(2) A combination of lamellae (that may or may not be part of the argillic horizon), and one or more parts of the argillic horizon 7.5 to 20 cm thick, each with an overlying eluvial horizon; *and*

2. Saturation with water, in one or more layers within 100 cm of the mineral soil surface, for 1 month or more per year in 6 or more out of 10 years.

Lamellic Oxyaquic Eutroboralfs

IBEJ. Other Eutroboralfs which:

1. Have a sandy particle-size class throughout the upper 75 cm of the argillic horizon, or throughout the entire argillic horizon if it is less than 75 cm thick; *and*.

2. Saturation with water, in one or more layers within 100 cm of the mineral soil surface, for 1 month or more per year in 6 or more out of 10 years.

Oxyaquic Psammentic Eutroboralfs

IBEK. Other Eutroboralfs that have *both*:

1. A sandy or sandy-skeletal particle-size class throughout a layer extending from the mineral soil surface to the top of an argillic horizon at a depth of 50 to 100 cm; *and*

2. Saturation with water, in one or more layers within 100 cm of the mineral soil surface, for 1 month or more per year in 6 or more out of 10 years.

Arenic Oxyaquic Eutroboralfs

IBEL. Other Eutroboralfs which *both*:

1. Have A glossic horizon; *and*

2. Are saturated with water, in one or more layers within 100 cm of the mineral soil surface, for 1 month or more per year in 6 or more out of 10 years.

Glossic Oxyaquic Eutroboralfs"

NSTH 615.62, p. 615-216. Renumber item IBEG. through IBEK. (renumbered above to IBEI. through IBEN.) as IBEM. to IBER.

NSTH 615.60, p. 615-188, following item BBEB. (changed to CBEB. Aquic Vitricryands) add item CBEC. as follows:

"CBEC. Other Vitricryands that are saturated with water, in one or more layers within 100 cm of the mineral soil surface, for 1 month or more per year in 6 or more out of 10 years.

Oxyaquic Vitricryands"

NSTH 615.60, p. 615-188, column 2, following item 6.; Add item 7. as follows:

"7. Are not saturated with water, in one or more layers within 100 cm of the mineral soil surface, for 1 month or more per year in 6 or more out of 10 years."

NSTH 615.60, p. 615-188, renumber items BBEC. through BBEF. (renumbered as CBEC. through CBEI.) as CBED. through CBEJ.

NSTH 615.91, p. 615-589, following item BDCA., (Aquic Fragiorthods), add BDCB. as follows:

"BDCB. Other Fragiorthods that:

1. Are saturated with water, in one or more layers within 100 cm of the mineral soil surface, for 1 month or more per year in 6 or more out of 10 years; *and*

2. Have, within 200 cm of the mineral soil surface, an argillic or a kandic horizon that has a base saturation of 35 percent or more (by sum of cations) in some part.

Alfic Oxyaquic Fragiorthods"

And renumber BDCB. through BDCG. as BDCC. through BDCH.

NSTH 615.91, p. 615-590, following item BDEE., (Aquic Haplorthods); Add items BDEF. and BDEG. as follows:

"BDEF. Other Haplorthods which have:

1. Within 200 cm of the mineral soil surface, an argillic or a kandic horizon that has a base saturation of 35 percent or more (by sum of cations) in some part; *and*

2. Saturation with water, in one or more layers within 100 cm of the mineral soil surface, for 1 month or more per year in 6 or more out of 10 years.

Alfic Oxyaquic Haplorthods

BDEG. Other Haplorthods which have:

1. Within 200 cm of the mineral soil surface, an argillic or a kandic horizon; *and*

2. Are saturated with water, in one or more layers within 100 cm of the mineral soil surface, for 1 month or more per year in 6 or more out of 10 years.

Oxyaquic Ultic Haplorthods"

And renumber BDEF. through BDEK. as BDEH. through BDEM.

615.152 Vermic great groups and subgroups

Page 109, Key to Great Groups, change item IAF. to read as follows:

"IAF. Other Aqualfs that have one or more layers at least 25 cm thick (cumulative) within a depth of 100 cm from the mineral soil surface, which have 50 percent or more (by volume) recognizable bioturbation such as filled animal burrows, wormholes, or casts.

Vermaqualfs"

And change items IAF. through IAJ. to IAG. through IAK.

Page 119; Before the section on Boralfs, add the following:

"**Vermaqualfs**

Vermaqualfs are the Aqualfs that have recognizable bioturbation such as filled animal burrows, wormholes, or casts. Bioturbation has not destroyed the argillic horizon. It has been shown that because krotovinas are dense, massive, compact, and stratified, they restrict water movement. Significant amounts of krotovinas in a soil affect soil morphology, soil hydrology, and soil behavior. These soils are known to occur along the coastal plain of Texas as well as other states in the southeastern United States.

Definition

Vermaqualfs are the Aqualfs that:

1. Do not have one or more horizons between 30 and 150 cm from the soil surface in which plinthite either forms a continuous phase or constitutes one half or more of the volume;

2. Have one or more layers at least 25 cm (cumulative) within a depth of 100 cm from the mineral soil surface, which have 50 percent or more (by volume) recognizable bioturbation such as filled animal burrows, wormholes, or casts;

3. Do not have a duripan, fragipan, or natric horizon;

4. Have a CEC of more than 16 cmol(+)/kg clay (by 1N NH_4OAC pH 7) and an ECEC of more than 12 cmol(+)/kg clay (sum of bases extracted with 1N NH_4OAc pH 7, plus 1N-KCl-extractable Al) in 50 percent or more either of the argillic or kandic horizon if less than 100 cm thick or of its upper 100 cm.

Key to subgroups

IAFA. Vermaqualfs that have an exchangeable sodium percentage of 7 or more (or a sodium adsorption ratio of 6 or more): *either* or *both*

1. Throughout the upper 15 cm of the argillic horizon; *and/or*

2. Throughout all horizons within 40 cm of the mineral soil surface.

Natric Vermaqualfs

IAFB. Other Vermaqualfs.

Typic Vermaqualfs

Definition of Typic Vermaqualfs

Typic Vermaqualfs are Vermaqualfs that have an exchangeable sodium percentage of less than 7 (and a sodium adsorption ratio of less than 6) both in some part of the upper 15 cm of the argillic horizon, and in some horizon within 40 cm of the mineral soil surface."

Page 114 and NSTH 615.62, p. 615-212, (Natraqualfs); Change items IACA. through IACE. (changed to IACB. through IACF.) to IACC. through IACG. and add new item IACB. to read as follows:

"IACB. Other Natraqualfs that have one or more layers at least 25 cm thick (cumulative) within a depth of 100 cm from the mineral soil surface, which have 25 percent or more (by volume) recognizable bioturbation such as filled animal burrows, wormholes, or casts.

Vermic Natraqualfs"

NSTH 615.90, p. 615-516, column 2, Definition of Typic Natraqualfs; After item 4. add the following:

"5. Do not have one or more layers at least 25 cm thick (cumulative) within a depth of 100 cm from the mineral surface, which have 25 percent or more (by volume) recognizable bioturbation such as filled animal burrows, wormholes, or casts."

NSTH 615.62, p. 615-210, Key to subgroups of Fragiaqualfs (Soil Taxonomy p. 112). Change IADA. through IADD. to IADB. through IADE. and add the following:

"IADA. Fragiaqualfs that have one or more layers at least 25 cm thick (cumulative) within a depth of 100 cm from the mineral soil surface, which have 25 percent or more (by volume) recognizable bioturbation such as filled animal burrows, wormholes, or casts.

Vermic Fragiaqualfs"

Page 239 and NSTH 615.62, p. 615-210, Definition of Typic Fragiaqualfs; After item 3. add the following:

"4. Do not have one or more layers at least 25 cm thick (cumulative) within a depth of 100 cm from the mineral soil surface, which have 25 percent or more (by volume) recognizable bioturbation such as filled animal burrows, wormholes, or casts."

Page 236, Key to great groups of Aquepts, following item IAI. (Tropaquepts, changed to JAG. in NSTH 615.60 p. 615-204). Add the following and renumber items JAH. through JAJ. as JAI. through JAK.

"JAH. Other Aquepts that have one or more layers at least 25 cm thick (cumulative) within a depth of 100 cm from the soil surface, which have 50 percent or more (by volume) recognizable bioturbation such as filled animal burrows, wormholes, or casts.

Vermaquepts"

Page 246 Before "Ochrepts", add the following:

"**Vermaquepts**

Vermaquepts are the Aquepts that have recognizable bioturbation such as filled animal burrows, wormholes, or casts. It has been shown that because krotovinas are dense, massive, compact, and stratified, they restrict water movement. Significant amounts of krotovinas in a soil affect soil morphology, soil hydrology, and soil behavior. These soils are known to occur along the coastal plain of Texas as well as other states in the southeastern United States.

Definition

Vermaquepts are the Aquepts that

1. Have one or more layers at least 25 cm thick (cumulative) within a depth of 100 cm from the soil surface, which have 50 percent or more (by volume) recognizable bioturbation such as filled animal burrows, wormholes, or casts.

2. Do not have a sulfuric horizon that has its upper boundary within 50 cm of the soil surface.

3. Do not have, in half or more of each pedon, a placic horizon within 100 cm of the mineral soil surface.

4. Do not have, in one or more horizons with a total thickness of 25 cm or more within 50 cm of the mineral soil surface, either an exchangeable sodium percentage (ESP) of 15 or more (or a sodium adsorption ratio, SAR, of 13 or more), and a decrease in ESP (or SAR) values with increasing depth below 50 cm.

5. Do not have a fragipan.

6. Have a soil temperature regime warmer than cryic.

7. Do not have one or more horizons within 125 cm of the mineral soil surface in which plinthite either forms

a continuous phase or constitutes one half or more of the volume.

8. Have a difference of 5°C or more between mean summer and mean winter soil temperatures either at a depth of 50 cm from the soil surface, or at a densic, lithic, or paralithic contact, whichever is shallower.

Key to subgroups

JAHA. Vermaquepts that have an exchangeable sodium percentage of 7 or more (or a sodium adsorption ratio, SAR, of 6 or more) in one or more subhorizons within 100 cm of the mineral soil surface.

Sodic Vermaquepts

JAHB. Other Vermaquepts.

Typic Vermaquepts

Definition of Typic Vermaquepts

Typic Vermaquepts are the Vermaquepts that do not have an exchangeable sodium percentage of 7 or more (or a sodium adsorption ratio, SAR, of 6 or more) in one or more subhorizons within 100 cm of the mineral soil surface."

615.153 Thapto-Histic Hydraquents

NSTH 615.62, p. 615-266 (Soil Taxonomy, p. 185); Delete item KABA. and add the following:

"KABA. Hydraquents that have a buried Histosol, or a buried histic epipedon, that has its upper boundary within 100 cm of the mineral surface.

Thapto-Histic Hydraquents

KABB. Other Hydraquents.

Typic Hydraquents"

"Definition of Typic Hydraquents

Typic Hydraquents are the Hydraquents that have neither a buried Histosol, nor a buried histic epipedon, that has its upper boundary within 100 cm of the mineral surface."

615.154 "Vitrandic" subgroups of Ustorthents

Page 200 and NSTH 615.62, p. 615-276, NSTH 615-89 p. 615-469, and NSTH 615.99 p. 615-596; Add the following new items, and renumber items KEEC. (Anthraquic Ustorthents) to KEEJ. as KEFE. through KEEL.:

"KEEC. Other Ustorthents that have *both*:

1. If neither irrigated nor fallowed to store moisture, have *one* of the following:

a. A frigid soil temperature regime, *and* a moisture control section which, in 6 or more out of 10 years, is dry in all parts for four tenths or more of the cumulative days per year when the soil temperature at a depth of 50 cm below the soil surface is higher than 5°C; *or*

b. A mesic or thermic soil temperature regime, *and* a moisture control section which, in 6 or more out of 10 years, is dry in some part for six tenths or more of the cumulative days per year when the soil temperature at a depth of 50 cm below the soil surface is higher than 5°C; *or*

c. A hyperthermic, an isomesic, or a warmer *iso* soil temperature regime, *and* a moisture control section which, in 6 or more out of 10 years, is moist in some or all parts for less than 180 cumulative days per year when the temperature at a depth of 50 cm below the soil surface is higher than 8°C; *and*

2. Throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the soil surface, *one or both* of the following:

a. More than 35 percent (by volume) fragments coarser than 2.0 mm, of which more than 66 percent are cinders, pumice, and pumice-like fragments; *or*

b. A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter, *and*:

(1) In the 0.02-to-2.0-mm fraction, 5 percent or more volcanic glass; *and*

(2) [(Aluminum plus 1/2 iron, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is equal to 30 or more.

Vitritorrandic Ustorthents

KEED. Other Ustorthents that have throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the soil surface, *one or both* of the following:

a. More than 35 percent (by volume) fragments coarser than 2.0 mm, of which more than 66 percent are cinders, pumice, and pumice-like fragments; *or*

b. A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter, and *either*:

(1) In the 0.02-to-2.0-mm fraction, 5 percent or more volcanic glass, *and*

(2) [(Aluminum plus 1/2 iron percentages (by ammonium oxalate) times 60] plus the volcanic glass (percent) is equal to 30 or more.

Vitrandic Ustorthents"

NSTH 615.62, p. 615-276. Definition of Typic Ustorthents; Change the "." at the end of item 5. to "; and" and add the following:

"6. Do not have throughout any horizon or horizons with a total thickness of 18 cm or more within 75 cm of the soil surface, *one or both* of the following:

a. More than 35 percent (by volume) fragments coarser than 2.0 mm, of which more than 66 percent are cinders, pumice, and pumice-like fragments; *nor*

b. A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter, *and*

(1) In the 0.02-to-2.0-mm fraction, 5 percent or more volcanic glass, *and*

(2) [(Aluminum plus 1/2 iron percentages (by ammonium oxalate) times 60] plus the volcanic glass (percent) equal to 30 or more."

615.155 Aquic Calciborolls

NSTH 615.89, p. 615-491; Change item HEFD. to the following:

"HEFD. Other Calciborolls that have, in one or more horizons within 100 cm of the mineral soil surface both:

1. Redoximorphic features; *and*

2. Aquic conditions for some time in most years (or artificial drainage).

Aquic Calciborolls"

NSTH 615.89, p. 615-492, Definition of Typic Calciborolls; Change item 1. to read as follows:

"1. Do not, in any horizon within 100 cm of the mineral soil surface have both, redoximorphic features and aquic conditions (or artificial drainage);"

615.156 Definition of Lamella and Lamellic and Psammentic subgroups

Page 48, column 1, after paragraph on "Durinodes", add the following:

"LAMELLAE

A lamella is an illuvial horizon less than 7.5 cm thick formed in unconsolidated regolith more than 50 cm thick. Each lamella contains an accumulation of oriented silicate clay on or bridging sand and silt grains (and rock fragments if any are present). A lamella has more silicate clay than the overlying eluvial horizon.

The significance of lamellae to soil classification is not in the single lamella but in the multiple number of lamellae each with an overlying eluvial horizon in a single pedon. A single lamella may occur in a pedon but, more commonly, there are several lamellae separated by eluvial horizons.

A lamella is a cambic horizon unless it is sandy (loamy fine sand or coarser). It may be a part of an argillic horizon. However, a single lamella is too thin to be an argillic horizon. A lamella is required to have an accumulation of oriented silicate clay but there is no specific amount of clay required. Some lamellae will have the required clay criteria for an argillic horizon. A combination of 2 or more of these lamellae may compose an argillic horizon.

Identification

A lamella is typically recognized by having (but is not required to have) a higher chroma, redder hue, or lower color value or any combination of these, than the overlying eluvial horizon. Some lamellae have no color difference. All lamellae are required to have more silicate clay than the overlying eluvial horizon.

In a vertical cross section of a pedon a lamella appears as a thin horizon and is often called a "band". It actually is an undulating layer and it is not always continuous. The upper and lower boundaries may be wavy and the thickness may vary from one point to another.

Lamellae commonly occur in sandy and sandy-skeletal sediments and less commonly in coarse-loamy, loamy-skeletal and coarse-silty sediments. The texture of the fine-earth in lamellae is mostly loamy sand or sandy loam but the texture is known to range from sand to sandy clay loam, silt loam and clay loam. The content of rock fragments ranges from none to more than 65 percent. Structure is commonly single grained or granular, but in some pedons the layer is massive.

Laboratory data show that, in addition to silicate clay accumulations, silt (particularly fine silt), sesquioxides, and organic carbon accumulate in some lamellae. Where there is recharge of carbonates, there may also be accumulations of carbonates in lamellae.

Although lamellae most commonly occur in eolian and alluvial sediments, they have also been observed in coarse grained residuum, such as grus. It is likely that there were very thin layers with finer soil particles and smaller pore spaces than in the residuum either above or below them. These thin layers would then be similar to the bedding planes in the eolian or alluvial sediments. It is logical that lamellae form in the same way in residuum as described below.

Origin

Lamellae form in coarse textured sediments (coarse silt or coarser) of eolian or alluvial deposits that include very small amounts of silicate clay. Evidence indicates that they form initially in the bedding planes. The bedding planes, as used here, are very thin layers with finer soil particles and smaller pore spaces then the materials either above or below them. These were deposited during a lull in the wind or a reduction in the velocity of the water. Before a wetting front can move through these bedding planes it must approach saturation. As a result, silicate clay, suspended in the soil water, is deposited on the larger soil particles. This further reduces the pore size. With the passing of each succeeding wetting front the pore size is reduced even further.

Eventually the lamellae begin to thicken. In thickening clay is deposited at the top of the lamella. At this point in their development, it is thought that lamellae may also begin to act as a filter.

In a close examination in pedons with a large number of lamellae, the lamellae nearer the soil surface generally have the least concentration of clay and have the faintest color contrast from the overlying eluvial horizon. Some sand grains are devoid of clay and some have only thin coatings. These lamellae are generally more wavy and less continuous than those in the other parts of the lamellae zone. The eluvial horizons overlying these lamellae are generally the thickest of those in the lamellae zone.

Lamellae in the middle part of the lamellae zone appear to have the highest concentration of clay at the upper edge of the lamella and clay content decreases with depth. The color contrast is the greatest at the upper edge of the lamella adjacent to the overlying eluvial horizon. In the lower part of these lamellae,

some sand grains are devoid of clay and some have only thin clay coatings. The lower part of these lamellae appear very similar to the entire lamella in the upper most part of the lamellae zone. These lamellae are wavy but commonly not as wavy as those in the upper part of the lamellae zone.

The deepest lamellae are commonly very thin. They have a color contrast that is nearly as great as the upper edge of the lamellae in the middle part of the lamellae zone. They are not very wavy and are commonly parallel with each other. The thickness of the overlying eluvial horizons is more variable than in the other parts of the lamellae zone.

From these observations, it is concluded that clay is being moved from the upper few lamellae to lower lying lamellae. Also, in the lamellae in the middle part of the layer containing lamellae, clay is being stripped from the lower part of one lamella and is being redeposited in the top of the next lower lamella. Consequently, by this process, an individual lamella is moving up in the pedon. It is also concluded that when a lamella begins to thicken, clay is being added to the upper part. At this point a lamella begins to move away from the bedding plane from which they originated. The stripping of clay from the lower part of a lamella and the redepositing in the top of the next lower lamella is a continuation of this movement upward and away from the bedding plane.

The movement upward of each lamella is not uniform throughout its extent. Consequently, lamellae are wavy rather than smooth like the bedding planes from which they originated. Occasionally, some lamellae appear to be branched. This occurs where a part of a lamella has moved up more rapidly than the overlying part of the next higher lamella and they become joined in this part. This is further evidence that lamellae move upward and that the movement is not uniform.

Summary of properties

A lamella is an illuvial horizon less than 7.5 cm thick formed in unconsolidated regolith more than 50 cm thick. Each lamella contains an accumulation of oriented silicate clay on or bridging the sand and silt grains (and coarse fragments if any are present). Each lamella is required to have more silicate clay than the overlying eluvial horizon.

Lamellae occur in a vertical series of 2 or more and each lamella must have an overlying eluvial horizon. (An eluvial horizon is not required above the upper most lamella if the soil is truncated.)

Lamellae may meet the requirements of either a cambic or an argillic horizon. A single lamella is a cambic horizon if the texture is very fine sand or loamy very fine sand or finer. A combination of two or more lamellae will meet the requirements of an argillic horizon if there is 15 cm or more cumulative total thickness of lamellae that are 0.5 cm or more thick and that have a clay content of either;

1. Three percent or more (absolute) higher than in the overlying eluvial horizon (e.g. 13 percent versus 10 percent) if any part of the eluvial horizon has less than 15 percent clay in the fine earth fraction or,

2. Twenty percent or more (relative) higher than in the overlying eluvial horizon (e.g. 24 percent versus 20 percent) if all parts of the eluvial horizon have more than 15 percent clay in the fine earth fraction."

Page 27 column 1, item 2, line 7; change "1 cm" to "0.5 cm".

Page 36 column 1, item 3b., (changed in NSTH 615.69 and 615.63 p. 615-423) after item 3b(1) add new item 3b(2). as follows and renumber items 3b(2) and 3b(3) as 3b(3) and 3b(4):

"(2) Lamellae (2 or more) within 200 cm of the soil surface; *or*"

NSTH 615.62, p. 615-216, delete item IBDF. (Psammentic Cryoboralfs, renumbered to item IBDH.) and insert the following:

"IBDH. Other Cryoboralfs which have an argillic horizon that:

1. Consists entirely of lamellae; *or*

2. Is a combination of two or more lamellae and one or more subhorizons with a thickness of 7.5 to 20 cm, each layer with an overlying eluvial horizon; *or*

3. Consists of one or more subhorizons which are more than 20 cm thick, each with an overlying eluvial horizon, and above these horizons there is either:

a. Two or more lamellae with a combined thickness of 5 cm or more (that may or may not be part of the argillic horizon); *or*

b. A combination of lamellae (that may or may not be part of the argillic horizon), and one or more parts of the argillic horizon 7.5 to 20 cm thick, each with an overlying eluvial horizon.

Lamellic Cryoboralfs

IBDI. Other Cryoboralfs that have a sandy particle-size class throughout the upper 75 cm of the argillic horizon, or throughout the entire argillic horizon if it is less than 75 cm thick.

Psammentic Cryoboralfs

IBDK. Other Cryoboralfs that have an argillic horizon that is 35 cm or less thick.

Ochreptic Cryoboralfs"

NSTH 615.62, p. 615-216, renumber items IBDG. to IBDI. (changed to IBDI. to IBDK.) as follows: IBDG. (Mollic) to IBDL., IBDH. (Glossic) to IBDJ., and IBDK (Typic) to IBDM.

NSTH 615.62, p. 615-216, Definition of Typic Cryoboralfs; Change item 5. to read:

"5. Have an argillic horizon that is finer than the sandy particle-size class in some part of the upper 75 cm if the argillic horizon is more than 75 cm thick, or in any part if the argillic horizon is less than 75 cm thick;"

NSTH 615.62, p. 615-216, Definition of Typic Cryoboralfs; Delete "and" at the end of item 5., change the "." at the end of item 6. to ";" and add the following new items:

"7. Have an argillic horizon that meets none of the following:

a. Consists entirely of lamellae; *or*

b. Is a combination of two or more lamellae and one or more subhorizons with a thickness of 7.5 to 20 cm, each

layer with an overlying eluvial horizon; *or*

c. Consists of one or more subhorizons which are more than 20 cm thick, each with an overlying eluvial horizon, and above these horizons there is either:

(1) Two or more lamellae with a combined thickness of 5 cm or more (that may or may not be part of the argillic horizon); *or*

(2) A combination of lamellae (that may or may not be part of the argillic horizon), and one or more parts of the argillic horizon 7.5 to 20 cm thick, each with an overlying eluvial horizon; and

8. Have an argillic horizon that is more than 35 cm thick."

NSTH 615.62, p. 615-217; Before item IBEG. (Psammentic Eutroboralfs, changed to item IBEN. above) insert the following new item:

"IBEN. Other Eutroboralfs which have an argillic horizon that:

1. Consists entirely of lamellae; *or*

2. Is a combination of two or more lamellae and one or more subhorizons with a thickness of 7.5 to 20 cm, each layer with an overlying eluvial horizon; *or*

3. Consists of one or more subhorizons which are more than 20 cm thick, each with an overlying eluvial horizon, and above these horizons there is either:

a. Two or more lamellae with a combined thickness of 5 cm or more (that may or may not be part of the argillic horizon); *or*

b. A combination of lamellae (that may or may not be part of the argillic horizon), and one or more parts of the argillic horizon 7.5 to 20 cm thick, each with an overlying eluvial horizon.

Lamellic Eutroboralfs"

NSTH 615.62, p. 615-217; Renumber and change item IBEG. (Psammentic Eutroboralfs, renumbered to IBEN. above) to read;

"IBEO. Other Eutroboralfs that have a sandy particle-size class throughout the upper 75 cm of the argillic horizon, or throughout the entire argillic horizon if it is less than 75 cm thick.

Psammentic Eutroboralfs"

NSTH 615.62, p. 615-217; Renumber item IBEH. (Arenic Eutroboralfs, renumbered as IBEO. above) as IBEP. and IBEJ. (Glossic Eutroboralfs, renumbered as IBER. above) as IBEQ.

NSTH 615.62, p. 615-217, following item IBEJ. (Glossic Eutroboralfs, changed to IBEQ. above); Insert the following as a new item IBER.:

"IBER. Other Eutroboralfs that have an argillic horizon that is 35 cm or less thick..

Ochreptic Eutroboralfs"

NSTH 615.62, p. 615-217; Renumber items IBEI. and IBEK. (renumbered as IBEP. [Mollic] and IBES. [Typic] above) as IBES. and IBET.

NSTH 615.62, p. 615-217, Definition of Typic Eutroboralfs; Change item 6. to read:

"6. Have an argillic horizon that is finer than the sandy particle-size class in some part of the upper 75 cm if the argillic horizon is more than 75 cm thick, or in any part if the argillic horizon is less than 75 cm thick;"

NSTH 615.62, p. 615-217, Definition of Typic Eutroboralfs; Delete "and" at the end of item 6., change "." to ";" at the end of item 7., and add the following new items after item 7.

"8. Have an argillic horizon that meets none of the following:

a. Consists entirely of lamellae; *or*

b. Is a combination of two or more lamellae and one or more subhorizons with a thickness of 7.5 to 20 cm, each layer with an overlying eluvial horizon; *or*

c. Consists of one or more subhorizons which are more than 20 cm thick, each with an overlying eluvial horizon, and above these horizons there is either:

(1) Two or more lamellae with a combined thickness of 5 cm or more (that may or may not be part of the argillic horizon); *or*

(2) A combination of lamellae (that may or may not be part of the argillic horizon), and one or more parts of the argillic horizon 7.5 to 20 cm thick, each with an overlying eluvial horizon; and

9. Have an argillic horizon that is more than 35 cm thick."

NSTH 615.62, p. 615-219; Insert the following new item before item IBFE. (Psammentic Glossoboralfs, changed to IBFF.);

"IBFF. Other Glossoboralfs which have an argillic horizon that:

1. Consists entirely of lamellae; *or*

2. Is a combination of two or more lamellae and one or more subhorizons with a thickness of 7.5 to 20 cm, each layer with an overlying eluvial horizon; *or*

3. Consists of one or more subhorizons which are more than 20 cm thick, each with an overlying eluvial horizon, and above these horizons there is either:

a. Two or more lamellae with a combined thickness of 5 cm or more (that may or may not be part of the argillic horizon); *or*

b. A combination of lamellae (that may or may not be part of the argillic horizon), and one or more parts of the argillic horizon 7.5 to 20 cm thick, each with an overlying eluvial horizon.

Lamellic Glossoboralfs"

NSTH 615.62, p. 615-219; Change item IBFE. (Psammentic Glossoboralfs, changed to item IBFF.) to:

"IBFG. Other Glossoboralfs that have a sandy particle-size class throughout the upper 75 cm of the argillic horizon, or throughout the entire argillic horizon if it is less than 75 cm thick.

Psammentic Glossoboralfs"

NSTH 615.62, p. 615-219; Insert the following new item after item IBFE. (Psammentic Glossoboralfs, changed to IBFG. above).

"IBFH. Other Glossoboralfs which have an argillic horizon 35 cm or less thick.
Ochreptic Glossoboralfs"

NSTH 615.62, p. 615-219; Renumber items IBFF. and IBFG. (changed to IBFG. and IBFH.) to IBFI. and IBFJ.

NSTH 615.62, p. 615-219, Definition of Typic Glossoboralfs; Change item 4 to read:

"4. Have an argillic horizon that is finer than the sandy particle-size class in some part of the upper 75 cm if the argillic horizon is more than 75 cm thick, or in any part if the argillic horizon is less than 75 cm thick;"

NSTH 615.62, p. 615-219, Definition of Typic Glossoboralfs; add the following new items:

"6. Have an argillic horizon that meets none of the following:

a. Consists entirely of lamellae; *or*

b. Is a combination of two or more lamellae and one or more subhorizons with a thickness of 7.5 to 20 cm, each layer with an overlying eluvial horizon; *or*

c. Consists of one or more subhorizons which are more than 20 cm thick, each with an overlying eluvial horizon, and above these horizons there is either:

(1) Two or more lamellae with a combined thickness of 5 cm or more (that may or may not be part of the argillic horizon); *or*

(2) A combination of lamellae (that may or may not be part of the argillic horizon), and one or more parts of the argillic horizon 7.5 to 20 cm thick, each with an overlying eluvial horizon; and

7. Have an argillic horizon that is more than 35 cm thick."

NSTH 615.62, p. 615-222; Delete item IEKF. (Psammaquentic Hapludalfs, changed to IEKJ.), renumber item IEKJ. (Anthraquic Hapludalfs, changed to item IEKN.) as IEKJ., and replace item IEKG. (Psammentic Hapludalfs, renumbered as IEKK.) with the following:

"IEKT. Other Hapludalfs that have a sandy particle-size class throughout the upper 75 cm of the argillic horizon, or throughout the entire argillic horizon if it is less than 75 cm thick.
Psammentic Hapludalfs"

NSTH 615.62, p. 615-222; Renumber (and reorder) items IEKH. through IEKO. (renumbered to IEKL. through IEKT.) and item IEKU. (Oxyaquic Hapludalfs added in NSTH 615.89 p. 615-439) as follows:

IEKH. to IEKJ., IEKI. to IEKU., IEKJ. to IEKK., IEKK. to IEKL., IEKL. to IEKM., IEKM. to IEKN., IEKN. to IEKO., and IEKO. to IEKP.; renumber Oxyaquic Hapludalfs as IEKR.

NSTH 615.62, p. 615-222; After (Oxyaquic Hapludalfs, changed to IEKR. above) insert the following;

"IEKS. Other Hapludalfs which have an argillic horizon that:

1. Consists entirely of lamellae; *or*

2. Is a combination of two or more lamellae and one or more subhorizons with a thickness of 7.5 to 20 cm, each layer with an overlying eluvial horizon; *or*

3. Consists of one or more subhorizons which are more than 20 cm thick, each with an overlying eluvial horizon, and above these horizons there is either:

a. Two or more lamellae with a combined thickness of 5 cm or more (that may or may not be part of the argillic horizon); *or*

b. A combination of lamellae (that may or may not be part of the argillic horizon), and one or more parts of the argillic horizon 7.5 to 20 cm thick, each with an overlying eluvial horizon.
Lamellic Hapludalfs"

NSTH 615.62, p. 615-222; Following items IEKP. and IEKQ. (Glossoboric Hapludalfs, renumbered to IEKV. and IEKW.) add the following new item:

"IEKX. Other Hapludalfs which have an argillic horizon 35 cm or less thick.
Ochreptic Hapludalfs"

NSTH 615.62, p. 615-224; Renumber items IEKR., IEKS., and IEKT. (changed to IEKX., IEKY., and IEKZ.) as IEKY., IEKZ., and IEKZa.

NSTH 615.62, p. 615-224, Definition of Typic Hapludalfs; change item 8. to read:

"8. Have an argillic horizon that is finer than the sandy particle-size class in some part of the upper 75 cm if the argillic horizon is more than 75 cm thick, or in any part if the argillic horizon is less than 75 cm thick;"

NSTH 615.62, p. 615-224, Definition of Typic Hapludalfs; Delete "and" at the end of item 10., change "." to a ";" at the end of item 11., and add the following new items;

"12. . Have an argillic horizon that meets none of the following:

a. Consists entirely of lamellae; *or*

b. Is a combination of two or more lamellae and one or more subhorizons with a thickness of 7.5 to 20 cm, each layer with an overlying eluvial horizon; *or*

c. Consists of one or more subhorizons which are more than 20 cm thick, each with an overlying eluvial horizon, and above these horizons there is either:

(1) Two or more lamellae with a combined thickness of 5 cm or more (that may or may not be part of the argillic horizon); *or*

(2) A combination of lamellae (that may or may not be part of the argillic horizon), and one or more parts of the argillic horizon 7.5 to 20 cm thick, each with an overlying eluvial horizon; and

13. Have an argillic horizon that is more than 35 cm thick."

NSTH 615.62, p. 615-227, following item IEIG. (Grossarenic Plinthic Paleudalfs, changed to IEII.); Add new item IEIJ. as follows:

"IEIJ. Other Paleudalfs which have an argillic horizon that:

1. Consists entirely of lamellae; *or*

2. Is a combination of two or more lamellae and one or more subhorizons with a thickness of 7.5 to 20 cm, each layer with an overlying eluvial horizon; *or*

3. Consists of one or more subhorizons which are more than 20 cm thick, each with an overlying eluvial horizon, and above these horizons there is either:

a. Two or more lamellae with a combined thickness of 5 cm or more (that may or may not be part of the argillic horizon); *or*

b. A combination of lamellae (that may or may not be part of the argillic horizon), and one or more parts of the argillic horizon 7.5 to 20 cm thick, each with an overlying eluvial horizon.

Lamellic Paleudalfs"

NSTH 615.62, p. 615-227; Renumber and change item IEIG. (changed to IEIJ.) to read:

"IEIK. Other Paleudalfs that have a sandy particle-size class throughout the upper 75 cm of the argillic horizon, or throughout the entire argillic horizon if it is less than 75 cm thick.

Psammentic Paleudalfs"

NSTH 615.62, p. 615-227; Renumber items IEII. through IEIO. (changed to IEIK. through IEIQ.) as IEIL. through IEIR.

NSTH 615.62, p. 615-228, Definition of Typic Paleudalfs; Change item 7. to read:

"7. Have an argillic horizon that is finer than the sandy particle-size class in some part of the upper 75 cm if the argillic horizon is more than 75 cm thick, or in any part if the argillic horizon is less than 75 cm thick;"

NSTH 615.62, p. 615-228, Definition of Typic Paleudalfs; Change "." at the end of item 9. to ";" and add the following new item:

"10. Have an argillic horizon that meets none of the following:

a. Consists entirely of lamellae; *or*

b. Is a combination of two or more lamellae and one or more subhorizons with a thickness of 7.5 to 20 cm, each layer with an overlying eluvial horizon; *or*

c. Consists of one or more subhorizons which are more than 20 cm thick, each with an overlying eluvial horizon, and above these horizons there is either:

(1) Two or more lamellae with a combined thickness of 5 cm or more (that may or may not be part of the argillic horizon); *or*

(2) A combination of lamellae (that may or may not be part of the argillic horizon), and one or more parts of the argillic horizon 7.5 to 20 cm thick, each with an overlying eluvial horizon."

NSTH 615.62, p. 615-229; Before item ICHG. (Psammentic Haplustalfs, changed to ICHK. above) insert the following new item:

"ICHK. Other Haplustalfs which have an argillic horizon that:

1. Consists entirely of lamellae; *or*

2. Is a combination of two or more lamellae and one or more subhorizons with a thickness of 7.5 to 20 cm, each layer with an overlying eluvial horizon; *or*

3. Consists of one or more subhorizons which are more than 20 cm thick, each with an overlying eluvial horizon, and above these horizons there is either:

a. Two or more lamellae with a combined thickness of 5 cm or more (that may or may not be part of the argillic horizon); *or*

b. A combination of lamellae (that may or may not be part of the argillic horizon), and one or more parts of the argillic horizon 7.5 to 20 cm thick, each with an overlying eluvial horizon.

Lamellic Haplustalfs"

NSTH 615.62, p. 615-229; Renumber and change item ICHG. (Psammentic Haplustalfs changed to ICHJ. and then to ICHK. above) to read:

"ICHL. Other Haplustalfs that have a sandy particle-size class throughout the upper 75 cm of the argillic horizon, or throughout the entire argillic horizon if it is less than 75 cm thick.

Psammentic Haplustalfs"

NSTH 615.62, p. 615-229; Renumber items ICHH. and ICHJ. (changed to ICHK. through ICHM. and then to ICHL. through ICHO. above), to ICHM. through ICHP.

NSTH 615.62, p. 615-229; Following item ICHJ. (Aridic Haplustalfs, changed to ICHM. and then to ICHP. above) insert the following new item:

"ICHQ. Other Haplustalfs which have an argillic horizon 35 cm or less thick.

Ochreptic Haplustalfs"

NSTH 615.62, p. 615-229; Renumber items ICHK. through ICHN. (renumbered to ICHN. through ICHQ. and then to ICHP. through ICHU. above) to ICHR. to ICHW.

NSTH 615.62, p. 615-230; Definition of Typic Haplustalfs; change item 5. to read:

"5. Have an argillic horizon that is finer than the sandy particle-size class in some part of the upper 75 cm if the argillic horizon is more than 75 cm thick, or in any part if the argillic horizon is less than 75 cm thick;

NSTH 615.62, p. 615-230; Definition of Typic Haplustalfs; delete item 9. and add the following new items:

"9. Have an argillic horizon that meets none of the following:

a. Consists entirely of lamellae; *or*

b. Is a combination of two or more lamellae and one or more subhorizons with a thickness of 7.5 to 20 cm, each

layer with an overlying eluvial horizon; *or*

c. Consists of one or more subhorizons which are more than 20 cm thick, each with an overlying eluvial horizon, and above these horizons there is either:

(1) Two or more lamellae with a combined thickness of 5 cm or more (that may or may not be part of the argillic horizon); *or*

(2) A combination of lamellae (that may or may not be part of the argillic horizon), and one or more parts of the argillic horizon 7.5 to 20 cm thick, each with an overlying eluvial horizon;

10. Have an argillic horizon more than 35 cm thick."

NSTH 615.62, p. 615-233; Add new item and renumber and revise item ICFC. (Psammentic Paleustalfs changed to ICFE) as follows:

"ICFH. Other Paleustalfs which have an argillic horizon that:

1. Consists entirely of lamellae; *or*

2. Is a combination of two or more lamellae and one or more subhorizons with a thickness of 7.5 to 20 cm, each layer with an overlying eluvial horizon; *or*

3. Consists of one or more subhorizons which are more than 20 cm thick, each with an overlying eluvial horizon, and above these horizons there is either:

a. Two or more lamellae with a combined thickness of 5 cm or more (that may or may not be part of the argillic horizon); *or*

b. A combination of lamellae (that may or may not be part of the argillic horizon), and one or more parts of the argillic horizon 7.5 to 20 cm thick, each with an overlying eluvial horizon.

Lamellic Paleustalfs

ICFI. Other Paleustalfs that have a sandy particle-size class in all subhorizons in the upper 75 cm of the argillic horizon, or throughout the argillic horizon if it is less than 75 cm thick.

Psammentic Paleustalfs"

NSTH 615.62, p. 615-233; Renumber items ICFD. to ICFQ. (renumbered as ICFF. to ICFT.) as follows:

ICFD. to ICFK. (Grossarenic), ICFE. to ICFE. (Aquic Arenic), ICFF. to ICFM. (Plinthic), ICFG. to ICFF. (Aquic), ICFH. to ICFN. (Petrocalcic), ICFI. to ICFJ. (Arenic Aridic), ICFJ. to ICFL. (Arenic), ICFK. to ICFO. (Calcidic), ICFL. to ICFP. (Aridic), ICFM. to ICFQ. (Kandic), ICFN. to ICFR. (Rhodic), ICFO. to ICFS. (Ultic), ICFP. to ICFT. (Udic), ICFQ. to ICFU. (Typic)

NSTH 615.89, p. 615-445; Renumber items ICFH. (renumber as ICFJ.) to ICFG.).

NSTH 615.62, p. 615-235, Definition of Typic Paleustalfs; Change item 11. to read:

"11. Have an argillic horizon that is finer than the sandy particle-size class in some part of the upper 75 cm if the argillic horizon is more than 75 cm thick, or in any part if the argillic horizon is less than 75 cm thick;"

NSTH 615.62, p. 615-235, Definition of Typic Paleustalfs; add the following new item:

"12. Have an argillic horizon that meets none of the following:

a. Consists entirely of lamellae; *or*

b. Is a combination of two or more lamellae and one or more subhorizons with a thickness of 7.5 to 20 cm, each layer with an overlying eluvial horizon; *or*

c. Consists of one or more subhorizons which are more than 20 cm thick, each with an overlying eluvial horizon, and above these horizons there is either:

(1) Two or more lamellae with a combined thickness of 5 cm or more (that may or may not be part of the argillic horizon); *or*

(2) A combination of lamellae (that may or may not be part of the argillic horizon), and one or more parts of the argillic horizon 7.5 to 20 cm thick, each with an overlying eluvial horizon."

NSTH 615.62, p. 615-238; Revise and renumber item IDGJ. (Psammentic Haploxeralfs, changed to number IDGK.) and add the following new items:

"IDGK. Other Haploxeralfs which have an argillic horizon that:

1. Consists entirely of lamellae; *or*

2. Is a combination of two or more lamellae and one or more subhorizons with a thickness of 7.5 to 20 cm, each layer with an overlying eluvial horizon; *or*

3. Consists of one or more subhorizons which are more than 20 cm thick, each with an overlying eluvial horizon, and above these horizons there is either:

a. Two or more lamellae with a combined thickness of 5 cm or more (that may or may not be part of the argillic horizon); *or*

b. A combination of lamellae (that may or may not be part of the argillic horizon), and one or more parts of the argillic horizon 7.5 to 20 cm thick, each with an overlying eluvial horizon.

Lamellic Haploxeralfs

IDGL. Other Haploxeralfs that have a sandy particle-size class in all subhorizons in the upper 75 cm of the argillic horizon, or throughout the argillic horizon if it is less than 75 cm thick.

Psammentic Haploxeralfs"

NSTH 615.62, p. 615-238; Renumber items IDGK. and IDGL. (renumbered to IDGL. and IDGM.) as IDGM. and IDGN. and add the following new item:

"IDGO. Other Haploxeralfs which have an argillic horizon with a thickness of 35 cm or less.

Ochreptic Haploxeralfs"

NSTH 615.62, p. 615-238; Renumber items IDGM., IDGN., and IDGO. (renumbered to IDGN., IDGO., and IDGP.) to IDGP., IDGQ., and IDGR. and in the Definition of Typic Haploxeralfs; change item 8. to read:

"8. Have an argillic horizon that is finer than the sandy particle-size class in some part of the upper 75 cm if the argillic horizon is more than 75 cm thick, or in any part if the argillic horizon is less than 75 cm thick;"

NSTH 615.62, p. 615-239, Definition of Typic Haploxeralfs; Add the following new items:

"12. Have an argillic horizon that meets none of the following:

a. Consists entirely of lamellae; *or*

b. Is a combination of two or more lamellae and one or more subhorizons with a thickness of 7.5 to 20 cm, each layer with an overlying eluvial horizon; *or*

c. Consists of one or more subhorizons which are more than 20 cm thick, each with an overlying eluvial horizon, and above these horizons there is either:

(1) Two or more lamellae with a combined thickness of 5 cm or more (that may or may not be part of the argillic horizon); *or*

(2) A combination of lamellae (that may or may not be part of the argillic horizon), and one or more parts of the argillic horizon 7.5 to 20 cm thick, each with an overlying eluvial horizon;

13. Have an argillic horizon that is more than 35 cm thick."

NSTH 615.62, p. 615-239; Following item IDFE. (Petrocalcic Palexeralfs, renumbered as IDFF.) insert the following new items:

"IDFG. Other Palexeralfs which have an argillic horizon that:

1. Consists entirely of lamellae; *or*

2. Is a combination of two or more lamellae and one or more subhorizons with a thickness of 7.5 to 20 cm, each layer with an overlying eluvial horizon; *or*

3. Consists of one or more subhorizons which are more than 20 cm thick, each with an overlying eluvial horizon, and above these horizons there is either:

a. Two or more lamellae with a combined thickness of 5 cm or more (that may or may not be part of the argillic horizon); *or*

b. A combination of lamellae (that may or may not be part of the argillic horizon), and one or more parts of the argillic horizon 7.5 to 20 cm thick, each with an overlying eluvial horizon.

Lamellic Palexeralfs

IDFH. Other Palexeralfs that have a sandy particle-size class in all subhorizons in the upper 75 cm of the argillic horizon, or throughout the argillic horizon if it is less than 75 cm thick.

Psammentic Palexeralfs"

NSTH 615.62, p. 615-240; Renumber items IDFF. through IDFM. (renumbered as IDFG. through IDEN.) to IDFI. through IDFP. and add the following new items to the Definition of Typic Palexeralfs:

"12. Have an argillic horizon that is finer than the sandy particle-size class in some part of the upper 75 cm if the argillic horizon is more than 75 cm thick, or in any part if the argillic horizon is less than 75 cm thick;

13. Have an argillic horizon that meets none of the following:

a. Consists entirely of lamellae; *or*

b. Is a combination of two or more lamellae and one or more subhorizons with a thickness of 7.5 to 20 cm, each layer with an overlying eluvial horizon; *or*

c. Consists of one or more subhorizons which are more than 20 cm thick, each with an overlying eluvial horizon, and above these horizons there is either:

(1) Two or more lamellae with a combined thickness of 5 cm or more (that may or may not be part of the argillic horizon); *or*

(2) A combination of lamellae (that may or may not be part of the argillic horizon), and one or more parts of the argillic horizon 7.5 to 20 cm thick, each with an overlying eluvial horizon."

Page 180 (and 181), column 2, item JC. (changed to KC.); Change to read:

"KC. Other Entisols that have less than 35 percent (by volume) rock fragments and a texture of loamy fine sand or coarser, in all layers within the control section for the family particle-size class.

Psamments"

Page 181, column 2, item JAF. (changed to KAD., NSTH 615.89, page 615-460); Change to read:

"KAD. Other Aquents that have less than 35 percent (by volume) rock fragments and a texture of loamy fine sand or coarser, in all layers within the control section for the family particle-size class.

Psammaquents"

NSTH 615.62, p. 615-272; Delete item KEAE. (Alfic Cryorthents changed to KEAF.) and renumber item KEAG. to KEAF.

NSTH 615.62, p. 615-272, Definition of Typic Cryorthents; Delete item 5.

NSTH 615.62, p. 615-297; Change item JDCF. (Alfic Cryochrepts, renumbered to JDDG.) to read:

"JDDG. Other Cryochrepts which have a cambic horizon composed of lamellae (two or more) within 200 cm of the mineral soil surface.

Lamellic Cryochrepts"

NSTH 615.62, p. 615-297, Definition of Typic Cryochrepts; Change item 6. to read:

"6. Do not have lamellae (two or more) within 200 cm of the mineral soil surface."

NSTH 615.62, p. 615-298; Insert the following new item before item JDGH. (Fluventic Umbric Dystrochrepts, renumbered as JDHJ.):

"JDGH. Other Dystrochrepts which have a cambic horizon composed of lamellae (two or more) within 200 cm of the mineral soil surface.

Lamellic Dystrochrepts"

NSTH 615.62, p. 615-298 and 615-299; Renumber items JDGH. through JDGM. (renumbered as JDHJ. through JDHO.) as JDHK. through JDHP.

NSTH 615.62, p. 615-299, Definition of Typic Dystrochrepts; Add the following new item:

"7. Do not have lamellae (two or more) within 200 cm of the soil surface."

NSTH 615.62, p. 615-300; Add the following new item before item JDFI. (Dystric Fluventic Eutrochrepts, renumbered as JDGK.):

"JDGK. Other Eutrochrepts which have a cambic horizon composed of lamellae (two or more) within 200 cm of the mineral soil surface.

Lamellic Eutrochrepts"

NSTH 615.62, p. 615-300; Renumber items JDFI. through JDFO. (renumbered as JDGK. through JDGQ.) as JDGL. through JDGR.

NSTH 615.62, p. 615-301, Definition of Typic Eutrochrepts; Add the following as a new item:

"11. Do not have lamellae (two or more) within 200 cm of the soil surface."

NSTH 615.62, p. 615-302, following JDDF. (Aquic Ustochrepts renumbered to IDEI. above); Insert the following as a new item:

"JDEJ. Other Ustochrepts which have a cambic horizon composed of lamellae (two or more) within 200 cm of the mineral soil surface.

Lamellic Ustochrepts"

NSTH 615.62, p. 615-302 and 615-303; Renumber items JDDG. through JDDJ. (renumbered to JDEJ. through JDET. above) as JDEK. through JDEU.

NSTH 615.62, p. 615-303, Definition of Typic Ustochrepts; Add the following as a new item:

"8. Do not have lamellae (two or more) within 200 cm of the soil surface."

NSTH 615.62, p. 615-304, following JDEK. (Aquic Xerochrepts renumbered to IDFL.); Insert the following new item:

"JDEM. Other Xerochrepts which have a cambic horizon composed of lamellae (two or more) within 200 cm of the mineral soil surface.

Lamellic Xerochrepts"

NSTH 615.62, p. 615-304 and 615-305; Renumber items JDEL. through JDEP. (renumbered to JDFM. through JDFQ.) to JDFN. through JDFR.

NSTH 615.62, p. 615-305, Definition of Typic Xerochrepts; Add the following new item:

"11. Do not have lamellae (two or more) within 200 cm of the soil surface."

NSTH 615.62, p. 615-312; Delete item JEDE. (Quartzipsammentic Haplumbrepts).

NSTH 615.62, p. 615-312; Renumber and revise item JEDF. as follows:

"JEDG. Other Haplumbrepts that have a sandy particle-size class in all subhorizons throughout the particle-size control section.

Psammentic Haplumbrepts"

NSTH 615.62, p. 615-312, renumber items as follows: JEDG. as JEDH.; JEDH. as JEDI.; JEDI. to JEDE.; JEDJ. (Fluventic Haplumbrepts, changed to JEDK.) to JEDJ.; JEDK. (Entic Haplumbrepts, renumbered to JEDL.) as JEDK.; JEDM. (Typic Haplumbrepts, renumbered to JEDM.) to JEDL.

NSTH 615.89, p. 615-486; Renumber item JEDJ. (Oxyaquic Haplumbrepts) as JEDF.

NSTH 615.62, p. 615-328; Renumber items HGBC. through HGBF. and revise item HGBC. (Psammentic Argiudolls, renumbered as HGCE.) as follows:

HGBD. (Andic Argiudolls, renumbered as HGCF.) as HGCE.; HGBE. (Vitrandic Argiudolls, renumbered as HGCG.) as HGCF.; HGBF. (Aquic Argiudolls, renumbered as HGCH.) as HGCG.; IGBG. (Oxic Argiudolls, renumbered as HGCK.) as IGCL.; IGBH. (Typic Argiudolls, renumbered as HGCM.) as IGCN.

"HGCJ. Other Argiudolls that have a sandy particle-size class throughout the upper 75 cm of the argillic horizon, or throughout the entire argillic horizon if it is less than 75 cm thick.

Psammentic Argiudolls"

NSTH 615.85, p. 615-405; Renumber item HGDJ. as HGGM.

NSTH 615.89, p. 615-494; Renumber item as HGCG. (Oxyaquic Argiudolls, renumbered to HGCI.) as HGCH.

NSTH 615.89, p. 615-494, following item HGCG. (Oxyaquic Argiudolls, renumbered to HGCI.); Insert the following:

"HGCI. Other Argiudolls which have an argillic horizon that:

1. Consists entirely of lamellae; *or*

2. Is a combination of two or more lamellae and one or more subhorizons with a thickness of 7.5 to 20 cm, each layer with an overlying eluvial horizon; *or*

3. Consists of one or more subhorizons which are more than 20 cm thick, each with an overlying eluvial horizon, and above these horizons there is either:

   a. Two or more lamellae with a combined thickness of 5 cm or more (that may or may not be part of the argillic horizon); *or*

   b. A combination of lamellae (that may or may not be part of the argillic horizon), and one or more parts of the argillic horizon 7.5 to 20 cm thick, each with an overlying eluvial horizon.

Lamellic Argiudolls"

NSTH 615.62, p. 615-328, Definition of Typic Argiudolls; Change item 3. to read:

"3. Have an argillic horizon that is finer than the sandy particle-size class in some part of the upper 75 cm if the argillic horizon is more than 75 cm thick, or in any part if the argillic horizon is less than 75 cm thick;"

NSTH 615.62, p. 615-329, Definition of Typic Argiudolls; Add the following as a new item;

"8. Have an argillic horizon that meets none of the following:

a. Consists entirely of lamellae; *or*

b. Is a combination of two or more lamellae and one or more subhorizons with a thickness of 7.5 to 20 cm, each layer with an overlying eluvial horizon; *or*

c. Consists of one or more subhorizons which are more than 20 cm thick, each with an overlying eluvial horizon, and above these horizons there is either:

(1) Two or more lamellae with a combined thickness of 5 cm or more (that may or may not be part of the argillic horizon); *or*

(2) A combination of lamellae (that may or may not be part of the argillic horizon), and one or more parts of the argillic horizon 7.5 to 20 cm thick, each with an overlying eluvial horizon."

NSTH 615.91, p. 615-590 Insert the following new item:

"BDEH. Other Haplorthods that have lamellae (two or more) below the spodic horizon.
Lamellic Haplorthods"

NSTH 615.91, p. 615-590; Renumber items BDEH. through BDEK. as BDEI. through BDEL.

NSTH 615.91, p. 615-591, Definition of Typic Haplorthods; Add the following new item:

"7. Do not have lamellae (two or more) below the spodic horizon."

NSTH 615.62, p. 615-372; Insert the following new item:

"GCGD. Other Hapludults that have *both*:

1. A sandy or sandy-skeletal particle-size class throughout a layer extending from the mineral soil surface to the top of an argillic horizon at a depth of 50 to 100 cm; *and*

2. In one or more subhorizons within the upper 60 cm of the argillic horizon, redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, accompanied by redox concentrations, and also aquic conditions for some time in most years (or artificial drainage).
Aquic Arenic Hapludults"

NSTH 615.62, p. 615-372; Renumber and revise item GCGD. as follows:

"GCGH. Other Hapludults that have a sandy particle-size class throughout the upper 75 cm of the argillic horizon, or throughout the entire argillic horizon if it is less than 75 cm thick.
Psammentic Hapludults"

NSTH 615.62, p. 615-372; Renumber items: GCGE. as GCGI., GCGF. as GCGJ., GCGG. as GCGE., GCGH. as GCGF., GCGI. as GCGL., and GCGK. as GCGM.

NSTH 615.62, p. 615-372; Renumber and revise item GCGJ. as follows:

"GCGK. Other Hapludults which have an argillic horizon 35 cm or less thick.
Ochreptic Hapludults"

NSTH 615.62, p. 615-372; Insert the following new item:

"GCGG. Other Hapludults which have an argillic horizon that:

1. Consists entirely of lamellae; *or*

2. Is a combination of two or more lamellae and one or more subhorizons with a thickness of 7.5 to 20 cm, each layer with an overlying eluvial horizon; *or*

3. Consists of one or more subhorizons which are more than 20 cm thick, each with an overlying eluvial horizon, and above these horizons there is either:

a. Two or more lamellae with a combined thickness of 5 cm or more (that may or may not be part of the argillic horizon); *or*

b. A combination of lamellae (that may or may not be part of the argillic horizon), and one or more parts of the argillic horizon 7.5 to 20 cm thick, each with an overlying eluvial horizon.
Lamellic Hapludults"

NSTH 615.62, p. 615-373, Definition of Typic Hapludults; Change item 3. to read:

"3. Have an argillic horizon more than 35 cm thick;

NSTH 615.62, p. 615-373, Definition of Typic Hapludults; Change item 6. to read:

"6. Have an argillic horizon that is finer than the sandy particle-size class in some part of the upper 75 cm if the argillic horizon is more than 75 cm thick, or in any part if the argillic horizon is less than 75 cm thick;"

NSTH 615.62, p. 615-373, Definition of Typic Hapludults; Add the following new item:

"9. Have an argillic horizon that meets none of the following:

a. Consists entirely of lamellae; *or*

b. Is a combination of two or more lamellae and one or more subhorizons with a thickness of 7.5 to 20 cm, each layer with an overlying eluvial horizon; *or*

c. Consists of one or more subhorizons which are more than 20 cm thick, each with an overlying eluvial horizon, and above these horizons there is either:

(1) Two or more lamellae with a combined thickness of 5 cm or more (that may or may not be part of the argillic horizon); *or*

(2) A combination of lamellae (that may or may not be part of the argillic horizon), and one or more parts of the argillic horizon 7.5 to 20 cm thick, each with an overlying eluvial horizon."

NSTH 615.62, p. 615-376; Delete item GCEB. (Psammaquentic Paleudults renumbered to GCEC.).

NSTH 615.62, p. 615-376, renumber and revise item GCEC. (Psammentic Paleudults, renumbered as GCED.) as follows:

"GCEJ. Other Paleudults that have a sandy particle-size class throughout the upper 75 cm of the argillic horizon, or throughout the entire argillic horizon if it is less than 75 cm thick.
Psammentic Paleudults"

NSTH 615.62, p. 615-377; Renumber item GCED.: (Arenic Plinthaquic Paleudults, renumbered to GCEE.) as GCEC. and change item 2.

"2. A sandy or sandy-skeletal particle-size class throughout a layer extending from the from the mineral soil surface to the top of an argillic horizon that is 50 cm or more below the mineral soil surface; *and*"

NSTH 615.62, p. 615-377; Renumber item GCEE. as GCED. and change item GCEE.2., (Aquic Arenic Paleudults, renumbered to item GCEF.1.) to read:

"1. A sandy or sandy-skeletal particle-size class throughout a layer extending from the from the mineral soil surface to the top of an argillic horizon that is 50 cm or more below the mineral soil surface."

NSTH 615.62, p. 615-377 and 378; Renumber: item GCEF. (Arenic Plinthic Paleudults, renumbered to GCEG.) as GCEK.; item GCEG. (Arenic Rhodic Paleudults, renumbered to GCEH.) as GCEL.; item GCEH. (Arenic Paleudults, renumbered to GCEI.) as GCEM.; item GCEI. (Grossarenic Plinthic Paleudults, renumbered to GCEJ.) as GCEN.; item GCEJ. (Grossarenic Paleudults, renumbered to GCEK.) as GCEO.; item GCEK. (Plinthaquic Paleudults, renumbered to GCEL.) as GCEF.; item GCEL. (Fragiaquic Paleudults, renumbered to GCEM.) as GCEG.; and item GCEM. (Aquic Paleudults, renumbered to GCEO.) as GCEH.

NSTH 615.62, p. 615-378; Insert the following new item:

"GCEI. Other Paleudults which have an argillic horizon that:

1. Consists entirely of lamellae; *or*

2. Is a combination of two or more lamellae and one or more subhorizons with a thickness of 7.5 to 20 cm, each layer with an overlying eluvial horizon; *or*

3. Consists of one or more subhorizons which are more than 20 cm thick, each with an overlying eluvial horizon, and above these horizons there is either:

a. Two or more lamellae with a combined thickness of 5 cm or more (that may or may not be part of the argillic horizon); *or*

b. A combination of lamellae (that may or may not be part of the argillic horizon), and one or more parts of the argillic horizon 7.5 to 20 cm thick, each with an overlying eluvial horizon.
Lamellic Paleudults"

NSTH 615.89, p. 615-513; Renumber item GCEK. (anthraquic Paleudults, renumbered to GCEN.) as GCEE.

NSTH 615.62, p. 615-379, Definition of Typic Paleudults; Change item 5. to read:

"5. Have an argillic horizon that is finer than the sandy particle-size class in some part of the upper 75 cm if the argillic horizon is more than 75 cm thick, or in any part if the argillic horizon is less than 75 cm thick;"

NSTH 615.62, p. 615-379, Definition of Typic Paleudults; Add the following new item:

"8. Have an argillic horizon that meets none of the following:

a. Consists entirely of lamellae; *or*

b. Is a combination of two or more lamellae and one or more subhorizons with a thickness of 7.5 to 20 cm, each layer with an overlying eluvial horizon; *or*

c. Consists of one or more subhorizons which are more than 20 cm thick, each with an overlying eluvial horizon, and above these horizons there is either:

(1) Two or more lamellae with a combined thickness of 5 cm or more (that may or may not be part of the argillic horizon); *or*

(2) A combination of lamellae (that may or may not be part of the argillic horizon), and one or more parts of the argillic horizon 7.5 to 20 cm thick, each with an overlying eluvial horizon."

NSTH 615.62, p. 615-379; Change item GCFB. to read:

"GCFB. Other Rhodudults that have a sandy particle-size class throughout the upper 75 cm of the argillic horizon, or throughout the entire argillic horizon if it is less than 75 cm thick.
Psammentic Rhodudults"

NSTH 615.62, p. 615-379, Definition of Typic Rhodudults; Change item 1. to read:

"1. Have an argillic horizon that is finer than the sandy particle-size class in some part of the upper 75 cm if the argillic horizon is more than 75 cm thick, or in any part if the argillic horizon is less than 75 cm thick;"

NSTH 615.62, p. 615-383; Change item GDEB. to read:

"GDEB. Other Rhodustults that have a sandy particle-size class throughout the upper 75 cm of the argillic horizon, or throughout the entire argillic horizon if it is less than 75 cm thick.
Psammentic Rhodustults"

NSTH 615.62, p. 615-383, Definition of Typic Rhodustults; Change item 1. to read:

"1. Have an argillic horizon that is finer than the sandy particle-size class in some part of the upper 75 cm if the argillic horizon is more than 75 cm thick, or in any part if the argillic horizon is less than 75 cm thick;"

NSTH 615.62, p. 615-383; Following item GEBC. insert item GEBG. (Andic Haploxerults), renumber as GEBD., and insert the following new item:

"GEBE. Other Haploxerults which have an argillic horizon that:

1. Consists entirely of lamellae; *or*

2. Is a combination of two or more lamellae and one or more subhorizons with a thickness of 7.5 to 20 cm, each layer with an overlying eluvial horizon; *or*

3. Consists of one or more subhorizons which are more than 20 cm thick, each

with an overlying eluvial horizon, and above these horizons there is either:

a. Two or more lamellae with a combined thickness of 5 cm or more (that may or may not be part of the argillic horizon); *or*

b. A combination of lamellae (that may or may not be part of the argillic horizon), and one or more parts of the argillic horizon 7.5 to 20 cm thick, each with an overlying eluvial horizon.

Lamellic Haploxerults"

NSTH 615.62, p. 615-383; Renumber and change item GEBD. to read:

"GEBF. Other Haploxerults that have a sandy particle-size class throughout the upper 75 cm of the argillic horizon, or throughout the entire argillic horizon if it is less than 75 cm thick.

Psammentic Haploxerults"

NSTH 615.62, p. 615-383; Renumber item GEBE. as GEBG., GEBF. as GEBH., and GEBH. as GEBI.

NSTH 615.62, p. 615-384, Definition of Typic Haploxerults; Change item 3. to read:

"3. Have an argillic horizon that is finer than the sandy particle-size class in some part of the upper 75 cm if the argillic horizon is more than 75 cm thick, or in any part if the argillic horizon is less than 75 cm thick;"

NSTH 615.62, p. 615-384, Definition of Typic Haploxerults; Add the following new item:

"7. Have an argillic horizon that meets none of the following:

a. Consists entirely of lamellae; *or*

b. Is a combination of two or more lamellae and one or more subhorizons with a thickness of 7.5 to 20 cm, each layer with an overlying eluvial horizon; *or*

c. Consists of one or more subhorizons which are more than 20 cm thick, each with an overlying eluvial horizon, and above these horizons there is either:

(1) Two or more lamellae with a combined thickness of 5 cm or more (that may or may not be part of the argillic horizon); *or*

(2) A combination of lamellae (that may or may not be part of the argillic horizon), and one or more parts of the argillic horizon 7.5 to 20 cm thick, each with an overlying eluvial horizon."

615.157 Combination "Vertic" Subgroups of Borolls and Udolls

NSTH 615.62, p. 615-317, NSTH 615.90 p. 615-537, NSTH 615.102 p. 615-600, and NSTH 615.127 p. 615-653; Renumber items: HEDB. as HEDK., HEDC. as HEDL., HEDD. as HEDM., HEDE. as HEDN., HEDF. as HEDB., HEDG. as HEDC., HEDH. as HEDG., HEDI. as HEDH., HEDJ. as HEDI., HEDK. as HEDJ., HEDL. through HEDU. as HEDO. through HEDX., and add the following:

"HEDD. Other Argiborolls which have:

1. A mollic epipedon 40 cm or more thick, of which 50 percent or more of the thickness has a texture finer than loamy fine sand; *and*

2. A udic moisture regime; *and*

3. One or both of the following:

a. Cracks within 125 cm of the mineral soil surface that are 5 mm or more wide through a thickness of 30 cm or more for some time in most years, and slickensides or wedge-shaped aggregates in a layer 15 cm or more thick that has its upper boundary within 125 cm of the mineral soil surface; *or*

b. A linear extensibility of 6.0 or more between the mineral soil surface and either a depth of 100 cm or a densic, lithic, or paralithic contact, whichever is shallower.

Pachic Udertic Argiborolls

HEDE. Other Argiborolls which have both:

1. A mollic epipedon 40 cm or more thick, of which 50 percent or more of the thickness has a texture finer than loamy fine sand; *and*

2. One or both of the following:

a. Cracks within 125 cm of the mineral soil surface that are 5 mm or more wide through a thickness of 30 cm or more for some time in most years, and slickensides or wedge-shaped aggregates in a layer 15 cm or more thick that has its upper boundary within 125 cm of the mineral soil surface; *or*

b. A linear extensibility of 6.0 or more between the mineral soil surface and either a depth of 100 cm or a densic, lithic, or paralithic contact, whichever is shallower.

Pachic Vertic Argiborolls

HEDF. Other Argiborolls which have:

1. A udic moisture regime; *and*

2. Either:

a. Above the argillic horizon, an albic horizon, or a horizon that has the color values too high for a mollic epipedon and a chroma too high for an albic horizon; *or*

b. A glossic horizon, or interfingering of albic materials into the upper part of the argillic horizon, or skeletans of clean silt and sand covering 50 percent or more of the faces pf peds in the upper

5 cm of the argillic horizon; *and*

3. One or both of the following:

a. Cracks within 125 cm of the mineral soil surface that are 5 mm or more wide through a thickness of 30 cm or more for some time in most years, and slickensides or wedge-shaped aggregates in a layer 15 cm or more thick that has its upper boundary within 125 cm of the mineral soil surface; *or*

b. A linear extensibility of 6.0 or more between the mineral soil surface and either a depth of 100 cm or a densic, lithic, or paralithic contact, whichever is shallower.

Boralfic Udertic Argiborolls"

NSTH 615.62, p. 615-318, item HEDF., (changed to HEDG. above); Change "Ustertic Argiborolls" to "Udertic Argiborolls" and change item. 2. to read as follows:

"2. A udic moisture regime."

NSTH 615.62, p. 615-323 and 324; Renumber items HEGD. through HEGW. as HEHI. through HEGZb. and add the following:

"HEGD. Other Haploborolls which have both:

1. In one or more horizons within 100 cm of the mineral soil surface, redox depletions with a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage); *and*

2. One or both of the following:

a. Cracks within 125 cm of the mineral soil surface that are 5 mm or more wide through a thickness of 30 cm or more for some time in most years, and slickensides or wedge-shaped aggregates in a layer 15 cm or more thick that has its upper boundary within 125 cm of the mineral soil surface; *or*

b. A linear extensibility of 6.0 or more between the mineral soil surface and either a depth of 100 cm or a densic, lithic, or paralithic contact, whichever is shallower.

Aquertic Haploborolls"

"HEGE. Other Haploborolls which have:

1. A mollic epipedon 40 cm or more thick, of which 50 percent or more of the thickness has a texture finer than loamy fine sand, and no densic nor paralithic contact nor sandy contrasting layer between 40 and 50 cm from the mineral soil surface; *and*

2. An irregular decrease in organic carbon content from a depth of 25 cm below the mineral soil surface to a depth of 125 cm, or to a densic, lithic, or paralithic contact if shallower; *and*

3. A slope of less than 25 percent and a concave shape; *and*

4. A udic moisture regime; *and*

5. One or both of the following:

a. Cracks within 125 cm of the mineral soil surface that are 5 mm or more wide through a thickness of 30 cm or more for some time in most years, and slickensides or wedge-shaped aggregates in a layer 15 cm or more thick that has its upper boundary within 125 cm of the mineral soil surface; *or*

b. A linear extensibility of 6.0 or more between the mineral soil surface and either a depth of 100 cm or a densic, lithic, or paralithic contact, whichever is shallower.

Cumulic Udertic Haploborolls

HEGF. Other Haploborolls which have:

1. A mollic epipedon 40 cm or more thick, of which 50 percent or more of the thickness has a texture finer than loamy fine sand, and no densic or paralithic contact nor sandy contrasting layer between 40 and 50 cm form the mineral soil surface; *and*

2. An irregular decrease in organic carbon content from a depth of 25 cm below the mineral soil surface to a depth of 125 cm, or to a densic, lithic, or paralithic contact if shallower; *and*

3. A slope of less than 25 percent and a concave shape; *and*

4. One or both of the following:

a. Cracks within 125 cm of the mineral soil surface that are 5 mm or more wide through a thickness of 30 cm or more for some time in most years, and slickensides or wedge-shaped aggregates in a layer 15 cm or more thick that has its upper boundary within 125 cm of the mineral soil surface; *or*

b. A linear extensibility of 6.0 or more between the mineral soil surface and either a depth of 100 cm or a densic, lithic, or paralithic contact, whichever is shallower.

Cumulic Vertic Haploborolls

HEGG. Other Haploborolls which have:

1. A mollic epipedon 40 cm or more thick, of which 50 percent or more of the thickness has a texture finer than loamy fine sand, and no densic or paralithic contact nor sandy contrasting layer between 40 and 50 cm from the mineral soil surface; *and*

2. A udic moisture regime; *and*

3. One or both of the following:

a. Cracks within 125 cm of the mineral soil surface that are 5 mm or more wide through a thickness of 30 cm or more for some time in most years, and slickensides or wedge-shaped aggregates in a layer 15 cm or more thick that has its upper boundary within 125 cm of the mineral soil surface; *or*

b. A linear extensibility of 6.0 or more between the mineral soil surface and either a depth of 100 cm or a densic, lithic, or paralithic contact, whichever is shallower.

Pachic Udertic Haploborolls

HEGH. Other Haploborolls which have both:

1. A mollic epipedon 40 cm or more thick, of which 50 percent or more of the thickness has a texture finer than loamy fine sand, and no densic or paralithic contact nor sandy contrasting layer between 40 and 50 cm from the mineral soil surface: *and*

2. One or both of the following:

a. Cracks within 125 cm of the mineral soil surface that are 5 mm or more wide through a thickness of 30 cm or more for some time in most years, and slickensides or wedge-shaped aggregates in a layer 15 cm or more thick that has its upper boundary within 125 cm of the mineral soil surface; *or*

b. A linear extensibility of 6.0 or more between the mineral soil surface and either a depth of 100 cm or a densic, lithic, or paralithic contact, whichever is shallower.

Pachic Vertic Haploborolls"

NSTH 615.62, p. 615-325; Renumber items HECA. through HECG. as HECD. through HECJ. and add the following:

"HECA. Natriborolls which have both:

1. Visible crystals of gypsum and/or more soluble salts within 40 cm of the mineral soil surface; *and*

2. One or both of the following:

a. Cracks within 125 cm of the mineral soil surface that are 5 mm or more wide through a thickness of 30 cm or more for some time in most years, and slickensides or wedge-shaped aggregates in a layer 15 cm or more thick that has its upper boundary within 125 cm of the mineral soil surface; *or*

b. A linear extensibility of 6.0 cm or more between the mineral soil surface and either a depth of 100 cm or a densic, lithic, or paralithic contact, whichever is shallower.

Leptic Vertic Natriborolls

HECB. Other Natriborolls which have:

1. A color value, dry, of 5 or more either in the upper 18 cm of the mollic epipedon, after mixing, or in an Ap horizon 18 cm or more thick; *and*

2. A moisture control section which, in 6 or more out of 10 years, is dry in some part for six tenths or more of the cumulative days when the soil temperature at a depth of 50 cm below the soil surface is higher than 5°C; *and*

3. One or both of the following:

a. Cracks within 125 cm of the mineral soil surface that are 5 mm or more wide through a thickness of 30 cm or more for some time in most years, and slickensides or wedge-shaped aggregates in a layer 15 cm or more thick that has its upper boundary within 125 cm of the mineral soil surface; *or*

b. A linear extensibility of 6.0 cm or more between the mineral soil surface and either a depth of 100 cm or a densic, lithic, or paralithic contact, whichever is shallower.

Torrertic Natriborolls

HECC. Other Natriborolls which have both:

1. A udic moisture regime; *and*

2. One or both of the following:

a. Cracks within 125 cm of the mineral soil surface that are 5 mm or more wide through a thickness of 30 cm or more for some time in most years, and slickensides or wedge-shaped aggregates in a layer 15 cm or more thick that has its upper boundary within 125 cm of the mineral soil surface; *or*

b. A linear extensibility of 6.0 cm or more between the mineral soil surface and either a depth of 100 cm or a densic, lithic, or paralithic contact, whichever is shallower.

Udertic Natriborolls"

NSTH 615.62, p. 615-328, (see 615.89, p. 615-493 and 615.104 p. 615-600); Before item HGCI. (Pachic Argiudolls changed to item HGCJ. and to CJHK. above) add the following new items and renumber items HGCI. (Pachic Argiudolls changed to CJHK. above) through HGBH (Typic Argiudolls, changed to HGBN. above) to HBGM. through HBGP.:

"HGCK. Other Argiudolls which have an argillic horizon that has a clay increase with depth of 20

percent or more (absolute, in the fine-earth fraction) within its upper 7.5 cm.
Abruptic Argiudolls"

NSTH 615.62, p. 615-328, (see 615.89, p. 615-493), change HGCM. (changed to HGCN. above) to HGCO. and add the following:

" HGCL. Other Argiudolls that have an albic horizon that is directly below the mollic epipedon or is a part of the (ochric) epipedon.
Albic Argiudolls"

NSTH 615.89, p. 615-492, Definition of Typic Argiudolls; Add the following:

"6. Do not have an argillic horizon that has a clay increase with depth of 20 percent or more (absolute, in the fine-earth fraction) within its upper 7.5 cm;

7. Do not have an albic horizon that is directly below the mollic epipedon or is a part of the (ochric) epipedon."

NSTH 615.130 p. 615-655; Change item HGEF. to read:

"HGEF. Other Hapludolls which have:

1. A mollic epipedon 60 cm or more thick, of which 50 percent or more of the thickness has a texture finer than loamy fine sand; *and*

2. *Either* 0.3 percent or more organic carbon at a depth of 125 cm below the mineral soil surface, *or* an irregular decrease in organic-carbon content from a depth of 25 cm to a depth of 125 cm, or to a densic, lithic, or paralithic contact if shallower; *and*

3. A slope of 25 percent or less; *and*

4. In one or more horizons within 100 cm of the mineral soil surface, redox depletions with a chroma of 2 or less, and also aquic conditions for some time in most years (or artificial drainage)."
Aquic Cumulic Hapludolls"

615.158 Changes to Natraquerts

NSTH 615.90, p. 615-550, column 1, item EAC., following "natric horizon" add the following:

" or have an exchangeable sodium percentage of 15 percent or more (or a sodium adsorption ratio of 13 or more) within 100 cm of the mineral soil surface"

NSTH 615.90, p. 615-550, Definition of Calciaquerts; Rewrite as follows:

"Calciaquerts are Aquerts which:

1. Have a calcic horizon that has its upper boundary within 100 cm of the mineral soil surface; and

2. Do not have a salic horizon nor a duripan that has its upper boundary within 100 cm of the mineral soil surface; and

3. Do not have a natric horizon nor an exchangeable sodium percentage of 15 percent or more (or a sodium adsorption ratio of 13 or more) within 100 cm of the mineral soil surface."

NSTH 615.90, p. 615-551, column 2, Definition of Dystraquerts, item 2.; Delete ", or a natric horizon" and add an item 3. as follows:

"3. Do not have a natric horizon nor an exchangeable sodium percentage of 15 percent or more (or a sodium adsorption ratio of 13 or more) within 100 cm of the mineral soil surface."

NSTH 615.90, p. 615-552, column 2, Definition of Endoaquerts, item 1.; Delete ", or a natric horizon" and add an item 4. as follows:

"4. Do not have a natric horizon nor an exchangeable sodium percentage of 15 percent or more (or a sodium adsorption ratio of 13 or more) within 100 cm of the mineral soil surface."

NSTH 615.90, p. 615-553, column 2, Definition of Epiaquerts, item 1.; Delete ", or a natric horizon" and add an item 4. as follows:

"4. Do not have a natric horizon nor an exchangeable sodium percentage of 15 percent or more (or a sodium adsorption ratio of 13 or more) within 100 cm of the mineral soil surface."

NSTH 615.90, p. 615-555, column 1, Definition of Natraquerts; Rewrite as follows:

"Natraquerts are Aquerts which:

1. Do not have a salic horizon nor a duripan that has its upper boundary within 100 cm of the mineral soil surface; and

2. Have a natric horizon or have an exchangeable sodium percentage of 15 percent or more (or a sodium adsorption ratio of 13 or more) within 100 cm of the mineral soil surface."

NSTH 615.115, p. 615-607, column 1, lines 31 and 32, rewrite the following sentence: "The secondary calcium carbonate generally is easy to recognize because it occurs as a white, powdery filling, as concretions, or as pendants or crusts below pebbles and stones." as follows:

"The *identifiable secondary carbonates* (defined below) are generally easy to recognize."

615.159 Family Amendment

This amendment is a result of recommendations from the International Committee on Families (ICOMFAM). The committee was established in 1987 with Dr. B. F. Hajek, Auburn University, as Chair.

Page 49, column 2; Delete entire section on Particle-size classes, and add the following:

"Particle-size classes

A number of the definitions of taxa have limits that vary with the amounts of sand, silt, clay, and rock fragments in selected horizons or within arbitrary limits of depth. Particle-size classes are used in some of the criteria and definitions of taxa in the chapters that follow. These classes are based on the grain-size distribution as defined in chapter 19. Most pararock fragments are broken into fragments 2.0 mm or less in diameter during the preparation of samples for particle size analysis and are therefore included with the fine earth in the particle-size classes. However, cinders, pumice and pumice-like fragments are treated as fragments in the following keys regardless of their rupture resistance class.

In contrast to the particle-size classes defined as part of the family level, the classes used in the following chapters (except chapter 19) are based on horizons or layers as defined in the

respective criteria rather than the particle-size control section (defined in chapter 19). Because they have a different control section, these classes are commonly different than the particle-size class defined for the family."

Page 80, column 1; Delete entire section on families and series and replace with the following:

"FAMILIES

In this category, the intent has been to group the soils within a subgroup having similar physical and chemical properties that affect their responses to management and manipulation for use. The responses of comparable phases of all soils in a family are nearly enough the same to meet most of our needs for practical interpretations of such responses. In some cases, soil properties are used in this category without regard to their significance as marks of soil forming processes. About 8,060 families are currently recognized in the United States.

The following are defined primarily to provide groupings of mineral soils with restricted ranges in:

1. Particle-size classes in horizons of major biologic activity below plow depth;

2. Mineralogy classes of the same horizons that are considered in naming particle-size classes;

3. Cation exchange activity classes of certain particle-size and mineralogy classes using the same horizons that are considered in naming particle-size classes;

4. Calcareous and reaction classes of horizons directly below plow depth;

5. Soil temperature classes;

6. Thickness of the soil penetrable by roots; and

7. Classes of coatings and classes of cracks are used in defining some families to produce the needed homogeneity.

These properties are important to the movement and retention of water and to aeration, both of which affect soil use for production of plants or for engineering purposes. The differentiae are discussed in more detail in chapter 19."

Page 84, column 1; Delete entire section on families and replace with the following:

"Families

Names of families are polynomial. Each consists of the name of a subgroup and descriptive terms, generally three or more, to indicate the particle-size class (or combinations thereof if strongly contrasting), the mineralogy (26 classes), the cation exchange activity (4 classes), the calcareous and reaction (4 classes), the temperature (8 classes), and, in a few families, depth of soil (3 classes), rupture resistance (2 classes), and classes of coatings and classes of cracks (3 classes). Names of most families have three to five descriptive terms that modify the subgroup name, but a few have only one or two and a few as many as six. An example given in table 6 is a family of fine-loamy (particle size), mixed (mineralogy), superactive (cation exchange activity), calcareous (calcareous and reaction), mesic (soil temperature) Typic Torrifluvents.

Series

Names of series as a rule are abstract place names. The name usually is taken from a place near the one where the series was first recognized. It may be the name of a town, a county, or some local feature. Some series have coined names. Many of the series names have been carried over from earlier classifications. Some have been in use since 1900. The name of a series carries no meaning to people who have no other source of information about the soils in it."

Page 84, column 2; Delete entire section "Meaning in the names" and replace with the following:

"MEANINGS IN THE NAMES

The Jocity and Youngston series (table 6) are two members of the fine-loamy, mixed, superactive, calcareous, mesic family of Typic Torrifluvents. The meaning of each of these terms is defined later, but in a general way the name tells us the following:

Fine-loamy means that from a depth of 25 to 100 cm there is no marked contrast in particle-size class, the content of clay is between 18 and 35 percent, 15 percent or more of the material is coarser than 0.1 mm in diameter (fine sand to very coarse sand plus gravel), but less than 35 percent by volume of the material is rock fragments 2.0 mm or more in diameter (less than about 50 percent by weight). The average texture, then, is more likely to be loam, clay loam, or sandy clay loam. *Mixed* means a mixed mineralogy, that is: There is less than 40 percent of any one mineral other than quartz in the fraction between 0.02 mm and 2.0 mm in diameter; Total iron plus gibbsite (by weight) in the fine-earth fraction is 5 percent or less; The fine-earth fraction has at least one of the following, free carbonates, the pH of a suspension of 1 g soil in 50 ml 1 M NaF is 8.4 or less after two minutes; *or* has a ratio of 1500 kPa water to measured clay of 0.6 or less; And less than 20 percent (by weight) glauconitic pellets in the fine-earth fraction. *Superactive* means the cation exchange capacity divided by the percent clay is 0.60 or more. *Calcareous* means that the soil has free carbonates in all parts from a depth of 25 to 50 cm and that, in this setting, it probably is calcareous throughout. *Mesic* indicates a mesic temperature regime, that is, the mean annual soil temperature is between 8°C and 15°C (47 and 59°F) and the soil temperature fluctuates more than 8°C between summer and winter. In other words, the soil is somewhere in the midlatitudes, summer is warm or hot, and winter is cool or cold. *Depth of soil* when no class is used, in Typic Torrifluvents, this means the soil is 50 cm or more deep.

The meaning of typic varies with the great group. *Torri* indicates a torric (dry) moisture regime. *Fluv* indicates sediments, probably alluvium, because fresh eolian sediments may be sandy, silty or clayey, but are rarely fine-loamy. *Ent*, the final syllable, tells us that the soil is an Entisol and has no cambic horizon nor a fragipan, no permafrost, no argillic, calcic, petrocalcic, gypsic, kandic, petrogypsic, placic, nor spodic horizon nor a duripan within 100 cm of the mineral soil surface, no sulfuric horizon within 150 cm of the mineral soil surface, and no histic, mollic, plaggen, nor umbric epipedon.

We can, therefore, visualize a soil on a flood plain or alluvial fan in an arid temperate climate. Although the soil may be a bit salty, it cannot be extremely salty. It probably has stratification but has no severe limitation for

irrigation. Under irrigation, iron chlorosis may be a problem in sensitive plants. If the soil is not irrigated, it can be used only for limited grazing."

Page 88, column 2; Delete entire section "Names of families" and replace with the following:

"Names of families

Each family requires one or more names. The technical family name consists of a series of descriptive terms modifying the subgroup name. For these terms we take the class names that are given later for particle-size class, mineralogy, and so on, in family differentiae (ch. 19). To have consistent nomenclature, the order of descriptive terms in names of families is particle-size class, mineralogy class, cation exchange activity class, calcareous and reaction class, soil temperature class, soil depth class, rupture resistance class, classes of coatings, and classes of cracks.

An alternate family name is the name of one of the series in the family. This is a shorter name intended primarily for use where a long name is inconvenient. This short name is most useful if the series is a common one that is well known in the locality.

Redundancy in names of families should be avoided. Particle-size class and temperature classes should not be used in the family name if they are specified in the subgroup name. Psamments, by definition, all have a sand or loamy sand texture and are in a sandy particle-size class, unless they are ashy. It is therefore redundant to use a particle-size class for Psamments, unless they are ashy. Similarly, all soils in suborders that have the formative element *bor* in the suborder name have frigid (or isofrigid) soil temperature class. Thus, frigid is redundant in the family names of Boralfs, Borohemists, and so on."

Page 383; Delete entire chapter 18 (renumbered as chapter 19 and insert the following new chapter:

"CHAPTER 19
FAMILY AND SERIES DIFFERENTIAE AND NAMES

It was pointed out earlier that families and series serve purposes that are largely pragmatic, that the series name is abstract, and that the technical family name is descriptive. In this chapter, the descriptive terms used in names of families are defined, the control sections to which the terms apply are given, and the criteria, including the taxa in which they are used are indicated. An example of a family is given to show how the family name is derived, and the differences between the two series in that family are pointed out as examples of series differentiae.

FAMILY DIFFERENTIAE FOR MINERAL SOILS AND MINERAL LAYERS OF SOME ORGANIC SOILS

To distinguish families of mineral soils and mineral layers of some organic soils within a subgroup, the following differentiae are used. The components of the family name are listed and defined in the same sequence in which the components appear in the family names.

Particle-size classes
Mineralogy classes
Cation exchange activity classes
Calcareous and reaction classes
Soil temperature classes
Soil depth classes
Rupture resistance classes
Classes of coatings
Classes of cracks

Particle-size classes and their substitutes

Definition of particle-size classes and substitutes for classes of mineral soils

The term *particle-size* class is used to characterize the grain-size composition of a whole soil (excluding organic matter and salts more soluble than gypsum), while the term *texture* is used in describing its fine-earth fraction, which consists of particles with a diameter of less than 2.0 mm. Substitutes for particle-size classes are used where normal particle-size classes do not characterize these components adequately.

The particle-size classes of this taxonomy represent a compromise between conventional divisions in pedologic and in engineering classifications. Engineering classifications have set the limit between sand and silt at a diameter of 74 microns, while pedologic classifications have put it at either 50 or 20 microns. Engineering classifications have been based on grain-size percentages by weight in the soil fraction less than 74 mm in diameter, while textural classes in pedologic classifications have been based on percentages by weight in the fraction less than 2.0 mm in diameter. In engineering classifications, the very-fine-sand separate (diameter between 0.05 mm and 0.1 mm) has been subdivided by the 74-micron limit. In defining the particle-size classes for this taxonomy, a similar division has been made, but in a different way. A fine sand or loamy fine sand normally contains an appreciable amount of very fine sand, but the very-fine-sand fraction is mostly coarser than 74 microns. A silty sediment such as loess may also contain an appreciable amount of very fine sand, most of which, however, is finer than 74 microns. So in designing the particle-size classes for this taxonomy, the very fine sand has been allowed to "float." It is included with the sand if the texture (fine-earth fraction) of a soil is sand, loamy fine sand, or coarser. It is, however, treated as silt if the texture is very fine sand, loamy very fine sand, sandy loam, silt loam, or finer.

No single set of particle-size classes seems adequate to serve as family differentiae for all the different kinds of soils. So this taxonomy is providing 2 generalized and 11 more narrowly defined classes, defined later in this chapter. This permits relatively fine distinctions between families of soils for which particle size is important, while providing broader groupings for soils in which narrowly defined particle-size classes would produce undesirable separations. Thus the term clayey is used for some soil families to indicate a clay content of 35 percent (30 percent in Vertisols) or more in specific horizons, while in other families the more narrowly defined terms fine and very fine indicate that these horizons have clay contents either of 35 (30 percent in Vertisols) to 60 percent, or of 60 percent or more, in their fine-earth fraction. The term fine earth refers to particles smaller than 2.0 mm in diameter. The term rock fragments means particles 2.0 mm or more in diameter that are strongly cemented or more resistant to rupture and includes all particles with horizontal dimensions smaller than the size of

a pedon. Cemented fragments 2.0 mm or more in diameter that are less strongly cemented are referred to as pararock fragments, and also includes all particles with horizontal dimensions smaller than the size of a pedon. Most pararock fragments are broken into fragments 2.0 mm or less in diameter during the preparation of samples for particle size analysis and are therefore included with the fine earth in the particle-size classes. However, cinders, pumice and pumice-like fragments are treated as fragments in the substitutes for classes regardless of their rupture resistance class.

There are two situations in which particle-size class names are not used. In one, the name is redundant such as for sandy Psamments and Psammaquents and psammentic subgroups. They have a sandy texture by definition and are in a sandy particle-size class or an ashy substitute class. No particle-size class is used in the family names of Psamments and Psammaquents and psammentic subgroups that are in a sandy particle-size class.

In the second situation substitutes for particle-size classes are used. Particle size analysis is difficult to apply to some soil materials that are derived from volcanic ejecta and/or have a high content of sequioxides and organic matter. Normal particle-size classes do not characterize these components adequately. They cannot be readily dispersed and the results of dispersion are variable. Consequently, substitutes for particle-size class names are used for those parts of soils that have andic soil properties or a high amount of volcanic glass, as is the case with Andisols and many andic and vitrandic subgroups of other soil orders. In addition, some other Spodosols, that are not identified in andic subgroups, have andic soil properties in some horizons within the particle-size control section, and particle-size class names are not used for these horizons. Particle-size class names are applied, although with reservations, to spodic horizons and other horizons that do not have andic soil properties but contain significant amounts of allophane, imogolite, ferrihydrite, or aluminum-humus complexes. The isotic mineralogy class (defined below) is helpful in identifying these particle-size classes.

In general, the weighted average particle-size class of the whole particle-size control section (defined below) determines what particle-size class name is used as a component of the family name. If a weighted average particle-size class name applies for one part and one or more substitute class names for the remaining parts of the control section, the name of the thickest part is used for that soil family.

If, however, the particle-size control section consists of two parts with strongly contrasting particle-size or substitute classes (listed below), if both parts are 12.5 cm or more thick (including parts not in the control section), and if the transition zone between them is less than 12.5 cm thick, both class names are used. For example, if a soil meets all of the following: criterion D. (listed below) under the control section for particle-size classes or their substitutes; any Ap horizon is less than 30 cm thick; the weighted average particle-size class of the upper 30 cm of the soil is sandy; the weighted average of the lower part is clayey; and the transition zone is less than 12.5 cm; the family particle-size class of that soil is sandy over clayey. If the particle-size control section includes more than one pair of the strongly contrasting classes, listed below, then the soil is placed in an aniso class named for the pair of adjacent classes that contrast most strongly. The aniso class is considered part of the particle-size class name and is set off by commas after the particle-size name. An example follows: sandy over clayey, aniso, mixed, active Aridic Haplustoll.

Generalized particle-size classes

Two generalized particle-size classes, loamy and clayey, are used with shallow classes (defined below) and soils in arenic, grossarenic, lithic, and pergelic subgroups. The clayey class is used in all strongly contrasting particle-size classes with more than 35 percent clay (30 percent in Vertisols). The loamy particle-size class is used in contrasting classes, where appropriate, to characterize the lower part of the particle-size control section. The generalized classes, where appropriate, are also used for all strongly contrasting particle-size classes that include a substitute class. For example, loamy over pumiceous or cindery (not fine-loamy over pumiceous or cindery) is used.

Six generalized classes, defined later in this chapter, are used in Terric subgroups of Histosols.

Control section for particle-size classes or their substitutes for mineral soils

The particle-size and substitute class names listed below are applied to certain horizons, or to the soil materials within specific depth limits, which have been designated as the particle-size control section. The lower boundary of the control section may be at a specified depth (in centimeters) from the mineral soil surface or the upper boundary of an organic layer with andic soil properties, or at the upper boundary of a root-limiting layer, i.e., a duripan; a fragipan; a petrocalcic, petrogypsic, or placic horizon; continuous ortstein; or at a densic, lithic, paralithic, or petroferric contact. The following list of particle-size control sections for particular kinds of mineral soils is arranged as a key. This key, like others in this taxonomy is designed in such a way that the reader makes the correct classification by going through the key systematically, starting at the beginning and eliminating one by one all classes which include criteria that do not fit the soil in question. The soil belongs to the first class listed for which the soil meets all the criteria listed. The upper boundary of an argillic, natric, or kandic horizon is used in the following key. This boundary is not always obvious. If one of these horizons is present but the upper boundary is irregular or broken, as in an A/B or B/A horizon, consider the depth at which half or more of the volume has the fabric of one of these horizons as the upper boundary.

Key to the control section for particle-size classes or their substitutes of mineral soils

A. For mineral soil soils that have the upper boundary of permafrost or a root limiting layer within 36 cm of the mineral soil surface use 1. or 2. below: *or* other mineral soils go to B. below

1. Permafrost: Between the mineral soil surface and a depth of 36 cm; *or*

2. A root-limiting layer: Between the mineral soil surface and the root-limiting layer.

B. For Andisols: Between either the mineral soil surface or the upper boundary of an organic layer with andic soil properties, whichever is shallower, and the shallowest of the following: (a) a depth of 100 cm, or (b) a root-limiting layer or contact, or (c) a depth of 25 cm below the upper boundary of permafrost. *or*

C. For those Alfisols, Ultisols, and great groups of Aridisols and Mollisols, excluding soils in Lamellic subgroups, which have an argillic, a kandic, or a natric horizon that has its upper boundary within 100 cm of the mineral soil surface and its lower boundary at a depth of 25 cm or more below the mineral soil surface, or which are in a grossarenic or arenic subgroup, use 1. through 4. below: *or* other soils go to D. below

1. Strongly contrasting particle-size classes (defined and listed later) within or below the argillic, kandic, or natric horizon *and* within 100 cm of the mineral soil surface: Between the upper boundary of the argillic, kandic, or natric horizon and either a depth of 100 cm from the mineral soil surface or a root-limiting layer or contact, whichever is shallower; *or*

2. All parts of the argillic, kandic, or natric horizon in or below a fragipan: Between a depth of 25 cm, from the mineral soil surface, and the fragipan; *or*

3. A fragipan at a depth of less than 50 cm below the top of the argillic, kandic, or natric horizon: Between the upper boundary of the argillic, kandic, or natric horizon and the fragipan; *or*

4. Other soils that meet C. above: Either the whole argillic, kandic, or natric horizon if less than 50 cm thick, *or* its upper 50 cm.

D. For those Alfisols, Ultisols, and great groups of Aridisols and Mollisols which are in a lamellic subgroup or have an argillic, a kandic or a natric horizon that has its upper boundary at a depth of 100 cm or more from the mineral surface, and which are not in a grossarenic or arenic subgroup: Between the lower boundary of an Ap horizon or a depth of 25 cm from the mineral soil surface, whichever is deeper, and a depth of 100 cm; *or*

E. For other soils which have an argillic or a natric horizon that has its lower boundary at a depth of less than 25 cm from the mineral surface: Between the upper boundary of the argillic or a natric horizon and a depth of 100 cm from the mineral soil surface, or to a root-limiting layer or contact, whichever is shallower; *or*

F. All other mineral soils: Between the lower boundary of an Ap horizon or a depth of 25 cm from the mineral soil surface, whichever is deeper, and the shallowest of the following: (a) a depth of 100 cm from the mineral soil surface, or (b) a root-limiting layer or contact, or (c) a depth of 25 cm below the upper boundary of permafrost.

Key to the particle-size and substitute classes of mineral soils

A. Mineral soils that have, in the thickest part of the control section, (if the control section is not in one of the strongly contrasting particle-size classes listed below), *or* in part of the control section (if that part qualifies as an element in one of the strongly contrasting particle-size classes listed below), *or* throughout the control section, a fine-earth component (including associated medium and finer pores) of less than 10 percent of the total volume; *and* meet one of the following sets of substitute class criteria:

1. Have, in the whole soil, more than 60 percent (by weight) volcanic ash, cinders, lapilli, pumice and pumice-like[1] fragments *and* in the fraction coarser than 2.0 mm, two thirds or more (by volume) pumice and/or pumice-like fragments.

Pumiceous

or

2. Have, in the whole soil, more than 60 percent (by weight) volcanic ash, cinders, lapilli, pumice and pumice-like fragments *and* in the fraction coarser than 2.0 mm, less than two thirds (by volume) pumice and pumice-like fragments.

Cindery

or

B. Other mineral soils that meet, in the thickest part of the control section (if the control section is not in one of the strongly contrasting particle-size classes listed below), *or* in part of the control section (if that part qualifies as an element in one of the strongly contrasting particle-size classes listed below), *or* throughout the control section, one of the following sets of substitute class criteria:

1. Have andic soil properties, and a water content at 1500 kPa tension of less than 30 percent on undried samples and less than 12 percent on dried samples; *or*

2. No andic soil properties, and a total of 30 percent or more of the 0.02-to-2.0-mm fraction (by grain count) consisting of volcanic glass, glass aggregates, glass-coated grains, and other vitric volcaniclastics; *and*

a. A total of 35 percent or more (by volume) rock and pararock fragments, of which two thirds or more (by volume) are pumice or pumice-like fragments.

Ashy-pumiceous

or

b. Have 35 percent or more (by volume) rock fragments.

Ashy-skeletal

or

c. Have less than 35 percent (by volume) rock fragments.

Ashy

or

3. Have a fine-earth fraction which has andic soil properties, *and* which has a water content at 1500 kPa tension of 12 percent or more on air-dried samples *or*

---

[1] Pumice-like - Vesicular pyroclastic materials other than pumice that have an apparent specific gravity (including vesicles) of less than 1.0 g/cm^3.

of 30 to 100 percent on undried samples: *and*

a. Have a total of 35 percent or more (by volume) rock and pararock fragments, of which two thirds or more (by volume) are pumice or pumice-like fragments.
Medial-pumiceous

or

b. Have 35 percent or more (by volume) rock fragments.
Medial-skeletal

or

c. Have less than 35 percent (by volume) rock fragments.
Medial

or

4. Have a fine-earth fraction which has andic soil properties, and which has a water content at 1500 kPa tension of 100 percent or more on undried samples: *and*

a. Have a total of 35 percent or more (by volume) rock and pararock fragments, of which two thirds or more (by volume) are pumice or pumice-like fragments.
Hydrous-pumiceous

or

b. Have 35 percent or more (by volume) rock fragments.
Hydrous-skeletal

or

c. Have less than 35 percent (by volume) rock fragments.
Hydrous

or

C. Other mineral soils that have a particle-size class that has (by weighted average) in the thickest part of the control section (if the control section is not in one of the strongly contrasting particle-size classes listed below), *or* in part of the control section (if that part qualifies as an element in one of the strongly contrasting particle-size classes listed below), *or* throughout the control section, a fine-earth component of less than 10 percent (including associated medium and finer pores) of the total volume.
Fragmental

or

[In the following classes "clay" excludes clay size carbonates. Carbonates of clay size are treated as silt. If the ratio of percent water retained at 1500 kPa tension to the percentage of measured clay is 0.25 or less or 0.6 or more in half or more of the particle-size control section or part of the particle-size control section in strongly contrasting classes, then the percentage of clay is estimated with the following formula:

Clay % = 2.5(% water retained at 1500 kPa tension - % organic carbon)]

D. Other mineral soils that meet, in the thickest part of the control section, (if part of the control section has a substitute for particle-size class and is not in one of the strongly contrasting particle-size classes listed below), *or* in part of the control section (if that part qualifies as an element in one of the strongly contrasting particle-size classes listed below), *or* throughout the control section meet one of the following sets of particle-size class criteria:

1. Soils with 35 percent or more (by volume) rock fragments; *and* a fine-earth fraction with a texture of sand or loamy sand, including less than 50 percent (by weight) very fine sand.
Sandy-skeletal

or

2. Other soils with 35 percent or more (by volume) rock fragments; *and* less than 35 percent (by weight) clay.
Loamy-skeletal

or

3. Other soils with 35 percent or more (by volume) rock fragments.
Clayey-skeletal

or

4. Other soils with a texture of sand or loamy sand, including less than 50 percent (by weight) very fine sand in the fine-earth fraction.
Sandy

or

5. Other soils, excluding Vertisols, in a shallow family (defined below), or in a lithic, arenic, grossarenic, or a pergellic subgroup, or the layer is an element in a strongly contrasting particle-size class (listed below) and the layer is the lower element or the other element is a substitute for particle-size class, and has a texture of loamy very fine sand, very fine sand, or a finer texture, including less than 35 percent (by weight) clay in the fine-earth fraction.
Loamy

or

6. Other soils that have in the fraction less than 75 mm in diameter, 15 percent or more (by weight) particles with diameters of 0.1 to 75 mm (fine sand or coarser, including rock fragments up to 7.5 cm in diameter); *and* less than 18 percent (by weight) clay in the fine-earth fraction.
Coarse-loamy

or

7. Other soils that have in the fraction less than 75 mm in diameter, 15 percent or more (by weight) particles with diameters of 0.1 to 75 mm (fine sand or coarser, including rock fragments up to 7.5 cm in diameter); *and* 18 to 35 percent (by weight) clay (Vertisols are excluded).
Fine-loamy

or

8. Other soils that have in the fraction less than 75 mm in diameter, less than 15 percent (by weight) particles with diameters of 0.1 to 75 mm (fine sand or coarser, including rock fragments up to 7.5 cm in diameter); *and* in the fine-earth fraction, less than 18 percent (by weight) clay.
Coarse-silty

or

9. Other soils that have in the fraction less than 75 mm in diameter, less than 15 percent (by weight) particles with diameters of 0.1 to 75 mm (fine sand or coarser, including rock fragments up to 7.5 cm in diameter); *and* in the fine-earth fraction, 18 to 35 percent (by weight) clay (Vertisols are excluded).
Fine-silty

or

10. Other soils in a shallow family (defined below), or in a lithic, arenic, grossarenic, or a pergellic subgroup, or the layer is an element in a strongly contrasting particle-size classes (listed below), with 35 percent or more (by weight) clay (more than 30 percent in Vertisols).

Clayey

or

11. Other soils that have (by weighted average) less than 60 percent (by weight) clay in the fine-earth fraction.

Fine

or

12. Other soils.

Very fine

Strongly contrasting particle-size classes

The purpose of strongly contrasting particle-size classes is to identify changes in pore-size distribution or composition, which are not identified in higher soil categories, and which seriously affect the movement and retention of water and/or nutrients.

The following particle-size or substitute classes are considered strongly contrasting if both parts are 12.5 cm or more thick (including parts not in the particle-size control section; however, substitute class names are used only if the soil materials to which they apply extend 10 cm or more into the upper part of the particle-size control section.), and if the transition zone between the two parts of the particle-size control section is less than 12.5 cm thick:

Some classes, such as sandy and sandy-skeletal, have been combined in some places in the following list. In those cases the combined name is used as the family class if part of the control section meets the criteria for either class.

1. Ashy over clayey.
2. Ashy over loamy-skeletal.
3. Ashy over loamy.
4. Ashy over medial-skeletal.
5. Ashy over medial if the water content at 1500 kPa tension in dried samples of the fine-earth fraction is 10 percent or less for the ashy materials and 15 percent or more for the medial materials.
6. Ashy over pumiceous or cindery if there is an absolute difference of 20 percent or more between volumes of rock fragments in the two parts of the control section.
7. Ashy over sandy or sandy-skeletal.
8. Ashy-skeletal over fragmental or cindery if the volume of the fine-earth fraction is 35 percent or more (absolute) greater in the ashy-skeletal part than in the fragmental or cindery part.
9. Cindery over loamy.
10. Cindery over medial-skeletal.
11. Cindery over medial.
12. Clayey over fine-silty if there is an absolute difference of 25 percent or more between clay percentages of the fine-earth fraction in the two parts of the control section.
13. Clayey over fragmental.
14. Clayey over loamy if there is an absolute difference of 25 percent or more between clay percentages of the fine-earth fraction in the two parts of the control section.
15. Clayey over loamy-skeletal if there is an absolute difference of 25 percent or more between clay percentages of the fine-earth fraction in the two parts of the control section.
16. Clayey over sandy or sandy-skeletal.
17. Clayey-skeletal over sandy or sandy-skeletal.
18. Coarse-loamy over clayey.
19. Coarse-loamy over fragmental.
20. Coarse-loamy over sandy or sandy-skeletal if the coarse-loamy material contains less than 50 percent fine or coarser sand.
21. Coarse-silty over clayey.
22. Coarse-silty over sandy or sandy-skeletal.
23. Fine-loamy over clayey if there is an absolute difference of 25 percent or more between clay percentages of the fine-earth fraction in the two parts of the control section.
24. Fine-loamy over fragmental.
25. Fine-loamy over sandy or sandy-skeletal.
26. Fine-silty over clayey if there is an absolute difference of 25 percent or more between clay percentages of the fine-earth fraction in the two parts of the control section.
27. Fine-silty over fragmental.
28. Fine-silty over sandy or sandy-skeletal.
29. Hydrous over clayey-skeletal.
30. Hydrous over clayey.
31. Hydrous over fragmental.
32. Hydrous over loamy-skeletal.
33. Hydrous over loamy.
34. Hydrous over sandy or sandy-skeletal.
35. Loamy over sandy or sandy-skeletal if the loamy material contains less than 50 percent fine or coarser sand.
36. Loamy over pumiceous or cindery.
37. Loamy-skeletal over clayey if there is an absolute difference of 25 percent or more between clay percentages of the fine-earth fraction in the two parts of the control section.
38. Loamy-skeletal over fragmental if the volume of the fine-earth fraction is 35 percent or more (absolute) greater in the loamy-skeletal part than in the fragmental part.
39. Loamy-skeletal over sandy or sandy-skeletal if the loamy material has less than 50 percent fine or coarser sand.
40. Medial over ashy if the water content at 1500 kPa tension in dried samples of the fine-earth fraction is 15 percent or more for the medial materials and 10 percent or less for the ashy materials.
41. Medial over clayey-skeletal.
42. Medial over clayey.
43. Medial over fragmental.
44. Medial over hydrous if the water content at 1500 kPa tension in undried samples of the fine-earth fraction is 75 percent or less for the medial materials.
45. Medial over loamy-skeletal.
46. Medial over loamy.
47. Medial over pumiceous or cindery.
48. Medial over sandy or sandy-skeletal.
49. Medial-skeletal over fragmental or cindery if the volume of the fine earth fraction is 35 percent or more (absolute) greater in the medial-skeletal part than the fragmental or cindery part.
50. Pumiceous or ashy-pumiceous over loamy.

51. Pumiceous or ashy-pumiceous over medial-skeletal.
52. Pumiceous or ashy-pumiceous over medial.
53. Pumiceous or ashy-pumiceous over sandy or sandy-skeletal.
54. Sandy over clayey.
55. Sandy over loamy if the loamy material contains less than 50 percent fine or coarser sand.
56. Sandy-skeletal over loamy if the loamy material contains less than 50 percent fine or coarser sand.

Mineralogy classes

The mineralogy of soil is known to be useful in making predictions of soil behavior and responses to management. Some mineralogy classes occur or are important only in certain taxa or particle-size classes, and others are important in all particle-size classes. The following key to mineralogy classes is designed to make those distinctions.

Control section for mineralogy classes

The control section for mineralogy classes is the same as that defined for the particle-size classes and their substitutes.

Key to mineralogy classes

This key, like the others in Soil Taxonomy, is designed in such a way that the reader makes the correct classification by going through the key systematically, starting at the beginning and eliminating one by one any classes which include criteria that do not fit the soil in question. The soil belongs into the first class listed for which it meets all the required criteria. The user should first check the criteria in section A and, if the soil in question does not meet the criteria listed there, proceed on to sections B, C, D, and E, until the soil meets the criteria listed.
For soils with strongly contrasting particle-size classes, the mineralogy for both named particle-sizes or substitutes are given, unless they are the same. Examples follow: ashy over clayey, mixed (if both the ashy and clayey are mixed), superactive, mesic Typic Vitraquand; clayey over sandy or sandy-skeletal, smectitic over mixed, thermic Vertic Ustochrept.

A. Oxisols and "kandi" and "kanhap" great groups of Alfisols and Ultisols that in the mineralogy control section have (by weighted average):

1. More than 40 percent iron oxide (more than 28 percent Fe by dithionite citrate) in the fine-earth fraction.
Ferritic

or

2. More than 40 percent gibbsite in the fine-earth fraction.
Gibbsitic

or

3. Both:

a. 18 to 40 percent iron oxide (12.6 to 28 percent Fe) (by dithionite citrate) in the fine-earth fraction; *and*

b. 18 to 40 percent gibbsite in the fine-earth fraction.
Sesquic

or

4. 18 to 40 percent iron oxide (12.6 to 28 percent Fe) (by dithionite citrate) in the fine-earth fraction.
Ferruginous

or

5. 18 to 40 percent gibbsite in the fine-earth fraction.
Allitic

or

6. More than 50 percent (by weight) kaolinite in the less than 0.002 fraction.
Kaolinitic

7. More than 50 percent (by weight) halloysite in the less than 0.002 fraction.
Halloysitic

or

8. All other properties.
Mixed

B. Other soil layers or horizons, in the mineralogy control section, that have a substitute class that replaces the particle-size class and that:

1. Have a sum of eight times the Si (percent by wt. extracted by acid oxalate) plus two times the Fe (percent by wt. extracted by acid oxalate) of 5 or more and eight times the Si is more than two times the Fe.
Amorphic

or

2. Other soils that have a sum of eight times the Si (percent by wt. extracted by acid oxalate) plus two times the Fe (percent by wt. extracted by acid oxalate) of 5 or more.
Ferrihydritic

or

3. Other soils that have 30 percent or more (by grain count) volcanic glass in the 0.02 to 2.0 mm fraction.
Glassy

or

4. All other soils that have modifiers that replace names of particle-size classes.
Mixed

C. Other mineral soil layers or horizons, in the mineralogy control section, in all other mineral soil orders and in terric subgroups of Histosols that have:

1. Any particle-size class, and more than 40 percent (by weight) carbonates (expressed as $CaCO_3$) plus gypsum, with gypsum constituting more than 35 percent of the total weight of carbonates plus gypsum, either in the fine-earth fraction or in the less-than-20-mm fraction, whichever has a higher percentage of carbonates plus gypsum.
Gypsic

or

2. Any particle-size class, and more than 40 percent (by weight) carbonates (expressed as $CaCO_3$) plus gypsum, either in the fine-earth fraction or in the less-than-20-mm fraction, whichever has a higher percentage of carbonates plus gypsum.
Carbonatic

or

3. Any particle-size class, except fragmental, and more than 40 percent (by weight) iron oxide (extractable by dithionite citrate), reported as Fe_2O_3 (or 28 percent reported as Fe), in the fine-earth fraction.

Ferritic

or

4. Any particle-size class, except fragmental, and more than 40 percent (by weight) hydrated aluminum oxides, reported as gibbsite and bohemite, in the fine-earth fraction.

Gibbsitic

or

5. Any particle-size class, except fragmental, and more than 40 percent (by weight) of magnesium-silicate minerals such as the serpentine minerals (antigorite, chrysotile, lizardite) plus talc, olivines, Mg-rich pyroxenes, and Mg-rich amphiboles in the fine-earth fraction.

Magnesic

or

6. Any particle-size class, except fragmental, and in the fine-earth fraction, in more than one half of the thickness, has all of the following:

a. No free carbonates; *and*

b. The pH of a suspension of 1 g soil in 50 ml 1 M NaF is more than 8.4 after two minutes; *and*

c. A ratio of 1500 kPa water to measured clay of more than 0.6; *and*

d. Does not have both more than one half (by weight) halloysite plus kaolinite *and* more halloysite than any other single mineral in the less-than-0.002-mm fraction.

Isotic

or

7. Any particle-size class, except fragmental, and a total iron oxide, by weight (Fe extracted by citrate-dithionite times 1.43 to report as Fe_2O_3) plus percent (by weight) gibbsite of more than 10 in the fine-earth fraction.

Parasesquic

or

8. Any particle-size class, except fragmental, and more than 20 percent (by weight) glauconitic pellets in the fine-earth fraction.

Glauconitic

or

D. Other mineral soil layers or horizons of soils in all other mineral orders and in terric subgroups of Histosols, in a clayey, clayey-skeletal, fine or very fine particle-size class, that in the less-than-0.002-mm fraction:

1. Have more than one half (by weight) halloysite plus kaolinite and allophane and more halloysite than any other single mineral.

Halloysitic

or

2. Have more than one half (by weight) kaolinite plus halloysite, dickite, and nacrite, and other 1:1 or non-expanding 2:1 layer minerals or gibbsite, and less than 10 percent (by weight) smectite.

Kaolinitic

or

3. Have more (by weight) smectite (montmorillonite, beidellite, and nontronite) than any other single kind of clay mineral.

Smectitic

or

4. Have more than one half (by weight) illite (hydrous mica), and commonly more than 4 percent K_2O.

Illitic

or

5. Have more vermiculite than any other single kind of clay mineral.

Vermiculitic

or

6. All other soils in this category.

Mixed

or

E. All other mineral soil layers that have:

1. More than 40 percent (by weight) mica and stable mica pseudomorphs in the 0.02-to-2.0-mm fraction.

Micaceous

or

2. More than 25 percent (by weight) mica and stable mica pseudomorphs in the 0.02-to-2.0-mm fraction.

Paramicaceous

or

3. More than 90 percent (by weight) silica minerals (quartz, chalcedony, or opal) and other extremely durable minerals that are resistant to weathering, in the 0.02-to-2.0-mm fraction.

Siliceous

or

4. All other properties.

Mixed

Cation exchange activity classes

The cation exchange activity classes help in making interpretations of mineral assemblages and of the nutrient holding capacity of soils in mixed and siliceous mineralogy classes of clayey, clayey-skeletal, coarse-loamy, coarse-silty, fine, fine-loamy, fine-silty, loamy, loamy-skeletal, and very fine particle-size classes. Cation exchange activity classes are not used in Histosols and they are not used Oxisols and "kandi" and "kanhap" great groups and subgroups of Alfisols and Ultisols because it would be redundant. Cation exchange activity classes are not used in sandy, sandy-skeletal, nor the fragmental class because the low clay content causes cation exchange activity classes to be less useful and less reliable.

The cation exchange capacity (CEC) is determined by NH_4OAc at pH 7 on the fine-earth fraction and includes the CEC of the organic matter, sand, silt, and clay. The criteria for the classes use ratios of CEC to the percent clay (by weight). If the ratio of percent water retained at 1500 kPa tension to the percentage of measured clay is 0.25 or less or 0.6 or more in half or more of the particle-size control section (or part in contrasting families), then the percentage of clay is estimated with the following formula:

Clay % = 2.5(% water retained at 1500 kPa tension - % organic carbon)

Control section for cation exchange activity classes

The control section for cation exchange activity classes is the same as that used to determine the particle-size and mineralogy classes. For soils with strongly contrasting particle-size classes, where both named parts of the control section use a cation exchange activity class, the class associated with the particle-size class that has the most clay is named. For example, in a pedon with a classification of loamy over clayey, mixed, active, calcareous, thermic Typic Udorthent, the cation exchange activity class, active, is associated with the clayey part of the control section.

Key to cation exchange activity classes

A. Soils in orders other than Histosols and Oxisols, *and* that *are not* in "kandi" or "kanhap" great groups or subgroups of Alfisols *and* Ultisols; that are in either a mixed *or* siliceous mineralogy class; are not in a fragmental, sandy, nor sandy-skeletal class; *and* that have a cation exchange capacity (by NH_4OAc at pH 7) to clay (percent by weight) ratio:

1. Of 0.60 or more. **Superactive**
2. Of 0.40 to 0.60. **Active**
3. Of 0.24 to 0.40. **Semiactive**
4. Of less than 0.24. **Subactive**

B. All other Soils:
No cation exchange activity classes used.

Calcareous and reaction classes of mineral soils

The presence or absence of carbonates, soil reaction, and the presence of high concentrations of aluminum in mineral soils are treated together because they are so intimately related. There are four classes: calcareous, acid, nonacid, and allic. They are defined later in the key to calcareous and reaction classes. These classes are not used in all taxa nor is more than one used in the same taxa.

Use of the calcareous and reaction classes

The calcareous, acid, and nonacid classes are used in the names of families of the Entisols, Aquands, and Aquepts except they are not used in any of the following:

1. Duraquands and Placaquands;
2. Sulfaquepts and Fragiaquepts;
3. Sandy, sandy-skeletal, cindery, pumiceous, or fragmental families;
4. Families with carbonatic or gypsic mineralogy.

The calcareous class, in addition to those listed above, is used in the names of families of Aquolls, except it is not used with any of the following:

1. Calciaquolls, Natraquolls, and Argiaquolls;
2. Cryaquolls and Duraquolls that have an argillic horizon;
3. Families with carbonatic or gypsic mineralogy.

The allic class is used only in families of Oxisols.

The control section for calcareous and reaction classes

The control section for the calcareous class is one of the following:

1. Soils with a densic, lithic, or paralithic contact that is 25 cm or less below the mineral soil surface; A 2.5 cm thick layer directly above the contact.

2. Soils with a densic, lithic, or paralithic contact that is 26 to 50 cm below the mineral soil surface; The layer between a depth of 25 cm below the mineral soil surface and the densic, lithic, or paralithic contact.

3. All other listed soils; Between a depth of 25 and 50 cm below the mineral soil surface.

The control section for the acid, nonacid, and allic classes is the same as for particle-size classes.

Key to calcareous and reaction classes

A. Oxisols that have a layer 30 cm or more thick within the control section which contains more than 2 cmol(+) of KCl extractable Al per kg soil in the fine-earth fraction. **Allic**

B. Other listed soils that, in the fine-earth fraction, effervesce (in cold dilute HCl) in all parts of the control section. **Calcareous**

C. Other listed soils with a pH of less than 5.0 in 0.01 M $CaCl_2$ (2:1) (about pH 5.5 in H_2O, 1:1) throughout the control section. **Acid**

D. Other listed soils with a pH is 5.0 or more in 0.01 M $CaCl_2$ (2:1) in some or all layers in the control section. **Nonacid**

It should be noted that a soil containing dolomite is calcareous, and that effervescence of dolomite, when treated with cold dilute HCl, is slow.

The calcareous, acid, nonacid, and allic classes are listed in the family name, when appropriate, following the mineralogy class. (NOTE: The rule that required parentheses around the calcareous class when it followed a mineralogy class is discontinued.)

Soil temperature classes

Soil temperature classes, as named and defined here, are used as family differentiae in both mineral and organic soils. The names are used as family modifiers unless the criteria for a higher taxon carry the same limitation. Thus frigid is implied in all boric and cryic suborders and cryic great groups and subgroups, and would be redundant if used in the names of families within these classes of soils.

The Celsius (centigrade) scale is the standard. It is assumed that the temperature is that of a soil that is not being irrigated.

Control section for soil temperature

The control section for soil temperature is either at a depth of 50 cm from the soil surface or at the upper boundary of a root-limiting layer, i.e., a duripan, a fragipan, a petrocalcic, petrogypsic, or placic horizon, or continuous ortstein; or at a densic, lithic, paralithic, or petroferric contact, whichever is shallower. The soil temperature classes, defined in terms of the mean annual soil temperature and difference between mean summer and mean winter temperature, are determined using the following key:

Key to soil temperature classes

A. Soils that have a difference in soil temperature of 5°C or more between mean summer (June, July, and August in the northern hemisphere) and mean winter (December, January, and February in the northern hemisphere) and a mean annual soil temperature of:

1. Lower than 8°C (47°F);
Frigid

or

2. 8° (47°F) to 15°C (59°F);
Mesic

or

3. 15° (59°F) to 22°C (72°F);
Thermic

or

4. 22°C (72°F) or higher.
Hyperthermic

B. All other soil that have mean annual soil temperature, as follows:

1. Lower than 8°C (47°F);
Isofrigid

or

2. 8° (47°F) to 15°C (59°F);
Isomesic

or

3. 15° (59°F) to 22°C (72°F);
Isothermic

or

4. 22°C (72°F) or higher.
Isohyperthermic

Soil depth classes

Distinctions are made to group soils according to soil depth. Soil depth classes are used in all families that have a root limiting layer at the specified depth from the mineral soil surface, except for those families in lithic subgroups and those with a fragipan. The root limiting layers included in depth of soil classes are: duripans; petrocalcic, petrogypsic, and placic horizons; continuous ortstein (90 percent or more); densic, lithic, paralithic, and petroferric contacts. One soil depth class name, shallow, is used to characterize certain mineral soil families that have one of the following depths. Soil depth classes for Histosols are given later in this chapter.

Key to soil depth classes

A. Oxisols that are less than 100 cm deep (from the mineral soil surface) to a root limiting layer, *and* not in a lithic subgroup.
Shallow

or

B. Soils in all other mineral soil orders, less than 50 cm deep (from the mineral soil surface) to a root limiting layer *and* not in a lithic subgroup.
Shallow

or:

C. All other mineral soils.
(No depth of soil class used)

Rupture resistance classes

In this taxonomy, some partially cemented horizons, e.g., durinodes, serve as differentiae in categories above the family, while others, such as partially cemented spodic materials (ortstein), do not. However, no single family should include soils both with and without partially cemented horizons. In Spodosols, a partially cemented spodic horizon is used as family differentia. The following two rupture resistance classes are defined for families of Spodosols:

A. Spodosols that have an ortstein horizon.
Ortstein

or

B. Other Spodosols.
Noncemented

C. All other soils.
(No class rupture resistance Used)

The noncemented class is not used in the name of any family.

Classes of coatings (on sands)

Despite the emphasis given to particle-size classes in the taxonomy, variability remains in the sandy particle-size class, which includes sands and loamy sands. Some sands are very clean, i.e., almost completely free of silt and clay, while others are mixed with appreciable amounts of finer grains. Clay is more efficient at coating sand than is silt. The value of the weighted average silt (by weight) plus two times the weighted average clay (by weight) equal to more than 5 makes a reasonable division of the sands at the family level. Two classes of Quartzipsamments are defined in terms of their silt-plus-two times clay content.

Control section for classes of coatings

The control section for classes of coatings is the same as for particle-size classes or their substitutes and for mineralogy classes.

Key to classes of coatings

A. Quartzipsamments that have a sum of the weighted average (by weight) silt plus two times the weighted average clay of more than 5.
Coated

or

B. Other Quartzipsamments.
Uncoated

C. All other soils.
(No classes of coatings used)

Classes of permanent cracks

Some Hydraquents consolidate or shrink after drainage and become Fluvaquents or Humaquepts. In the process they can form polyhedrons roughly 12 to 50 cm in diameter, depending on their *n* value and texture. These polyhedrons are separated by cracks that range in width from 2 mm to more than 1 cm. The

polyhedrons may shrink and swell with changes in the moisture content of the soil, but the cracks are permanent and can persist for several hundreds of years even though the soils are cultivated. These cracks permit rapid movement of water through the soil, either vertically or laterally. But such soils may have the same texture, mineralogy, and other family properties as soils which are not cracked or which have cracks that open and close with the seasons. Soils with permanent cracks are very rare in the United States.

The control section for classes of permanent cracks

The control section for classes of permanent cracks is from the base of any plow layer or 25 cm from the soil surface, whichever is deeper, to 100 cm below the soil surface.

Key to classes of permanent cracks

A. Fluvaquents or Humaquepts that have, throughout a layer 50 cm or more thick, continuous, permanent lateral and vertical cracks 2 mm or more wide, spaced at average lateral intervals of less than 50 cm.
Cracked

or

B. All other soils.
(No class of permanent cracks is used.)

FAMILY DIFFERENTIAE FOR HISTOSOLS

Most of the differentiae which are used to distinguish families of Histosols have already been defined, either because they are used as differentiae in mineral soils as well as Histosols, or because their definitions are used for the classification of some Histosols in categories higher than the family. In the following, differentiae not previously mentioned are defined and the classes in which they are used are enumerated.

The order in which family classes, if appropriate for a particular family, are placed in the technical family names of Histosols, is as follows:

Particle-size classes
Mineralogy classes, including nature of limnic deposits
Reaction classes
Soil temperature classes
Soil depth classes

Particle-size classes

Particle-size classes are used only for the family names of terric subgroups of Histosols. The classes are determined from the properties of the mineral soil materials in the control section using the key to particle-size classes. The classes used are more generalized than those used for soils in other orders.

Control section for particle-size classes

The particle-size control section is the upper 30 cm of the mineral layer or of that part of the mineral layer that is within the control section for Histosols (given in chapter 4), whichever is thicker.

Key to particle-size classes of Histosols

A. Terric subgroups of Histosols that have (by weighted average) in the particle-size control section:

1. A fine-earth component of less than 10 percent (including associated medium and finer pores) of the total volume.
Fragmental

or

2. A texture of sand or loamy sand, including less than 50 percent (by weight) very fine sand in the fine-earth fraction.
Sandy or sandy-skeletal

or

3. Less than 35 percent clay, in the fine-earth fraction, and a rock fragment content of 35 percent or more of the total volume
Loamy-skeletal

or

4. A rock fragment content of 35 percent or more of the total volume
Clayey-skeletal

or

5. A clay content of 35 percent or more in the fine-earth fraction.
Clayey

or

6. All other terric subgroups of Histosols.
Loamy

B. All other Histosols.
(No particle-size class used)

Mineralogy classes

There are three different kinds of mineralogy classes recognized for families in certain great groups and subgroups of Histosols. The first kind is the ferrihumic soil material defined below. Second there are three kinds of limnic materials; coprogenous earth, diatomaceous earth, and marl defined in chapter 4. The third kind are mineral layers of terric subgroups. They use the same key to mineralogy classes as mineral soils.

Ferrihumic mineralogy class

Ferrihumic soil material, i.e., bog iron, is an authigenic (formed in place) deposit consisting of hydrated iron oxide mixed with organic matter, either dispersed and soft or cemented into large aggregates, in a mineral or organic layer that has all the following characteristics:

1. Saturation with water for more than 6 months per year (or artificial drainage);

2. Two percent or more (by weight) iron concretions with lateral dimensions ranging from less than 5 mm to more than 100 mm, containing 10 percent or more (by weight) free iron oxide (7 percent or more Fe) and 1 percent or more (by weight) organic matter; and

3. A dark reddish or brownish color which changes little on drying.

The ferrihumic mineralogy class is used for families of Fibrists, Hemists, and Saprists, except it is not used in Sphagnofibrists and sphagnic subgroups of other great groups. If the ferrihumic class is used in the family name of a Histosol, no other mineralogy classes are used for that family because the presence of

iron is considered to be by far its most important mineralogical characteristic.

Mineralogy classes applied only to limnic subgroups

Limnic materials (defined in chapter 4) with a thickness of 5 cm or more are mineralogy class criteria, if the soil does not also have ferrihumic mineralogy. The following family classes are used: Coprogenous; Diatomaceous; Marly.

The control section for the ferrihumic mineralogy class and mineralogy classes applied to limnic subgroups

The control section for the ferrihumic mineralogy class and the classes applied to limnic subgroups is the same as the control section for Histosols.

Mineralogy classes applied only to terric subgroups

Histosols in terric subgroups, use the same key to mineralogy classes used for mineral soils unless the soil also has ferrihumic mineralogy.

The control section for mineralogy classes applied only to terric subgroups

Terric subgroups of Histosols use the same control section for mineralogy classes, as that used for the particle-size classes.

Key to mineralogy classes

A. Histosols, except folists, Sphagnofibrists, and sphagnic subgroups of other great groups, that have ferrihumic soil material within the control section for Histosols.

Ferrihumic

B. Other Histosols that have within the control section for Histosols limnic materials, 5 cm or more thick, that consist of:

1. Coprogenous earth.

Coprogenous

or

2. Diatomaceous earth.

Diatomaceous

or

3. Marl.

Marly

C. Other Histosols in terric subgroups.
Use Key to Mineralogy Classes (for mineral soils).

D. All other Histosols.
No Mineralogy class used.

Reaction classes

Reaction classes are used in all families of Histosols. The two classes recognized are defined in the following key:

A. Histosols that have a pH value, on undried samples, of 4.5 or more (in 0.01 M $CaCl_2$) in one or more layers of organic soil materials within the control section for Histosols.

Euic

or

B. All other Histosols.

Dysic

Soil temperature classes

The soil temperature classes of Histosols are determined using the same key and definitions as those used for mineral soils. The modifier frigid, however, would be redundant in the family names of boric and cryic great groups and cryic and pergelic subgroups and is therefore omitted.

Soil depth classes

Soil depth classes refer to the depth to a root limiting layer, a fragmental particle-size class, or to a cindery, or pumiceous substitute class. The root limiting layers included in depth of soil classes are duripans; petrocalcic, petrogypsic, and placic horizons; continuous ortstein; densic, lithic, paralithic, and petroferric contacts. The following key is used for families in all subgroups of Histosols. The shallow class is not used in the suborder of Folists.

Key to soil depth classes

A. Histosols that are less than 18 cm deep to a root limiting layer, to a fragmental particle-size class, or to a cindery or pumiceous substitute class;

Micro

or

B. Other Histosols, excluding Folists, that have a root limiting layer, a fragmental particle-size class, or a cindery or pumiceous substitute class between 18 and 50 cm from the soil surface;

Shallow

or

C. All other Histosols.
(No soil depth class used)

Series differentiae within a family

The function of the series is pragmatic, and differences within a family that affect the use of a soil should be considered in classifying soil series. The separation of soils at the series level of this taxonomy can be based on any property that is used as criteria at higher levels in the system. Those criteria most commonly used include presence of, depth to, thickness of, and expression of horizons and properties diagnostic for the higher categories and on differences in texture, mineralogy, soil moisture, soil temperature, and amounts of organic matter. The limits of the properties used as differentiae must be more narrowly defined than the limits for the family. However, the properties used must be reliably observable or be inferable from other soil properties or from the setting or the vegetation.

The differentiae used must be within the series control section. Differences in soil or regolith which are outside the series control section and that have not been recognized as series differentiae, but which are relevant to potential uses of certain soils, are considered as a basis for phase distinctions.

Control section for the differentiation of series

The control section for the soil series is similar to those for the family, but it differs in a few important respects. The particle-size and

mineralogy control sections for families end at the upper boundary of a fragipan, duripan, or petrocalcic horizon because these horizons contain few roots, and in contrast to the control section for the series, those for the family do not take into account the thickness of such horizons. The series control section includes materials starting at the soil surface and also considers the first 25 cm below a densic and paralithic contact if its upper boundary is less than 125 cm below the mineral soil surface. Properties of horizons and layers below the particle-size control section between 100 and 150 cm (or to 200 cm if in a diagnostic horizon) from the mineral soil surface are also considered.

Key to the control section for the differentiation of series

The part of a soil to be considered in differentiating series within a family is as follows:

A. Mineral soils that have permafrost within 150 cm of the soil surface. From the soil surface to the shallowest of the following:

1. A lithic or petroferric contact; *or*

2. A depth of 100 cm if depth to permafrost is less than 75 cm; *or*

3. 25 cm below the upper boundary of permafrost, if that boundary is 75 cm or more below the soil surface; *or*

4. 25 cm below a densic or paralithic contact; *or*

5. A depth of 150 cm.

B. Other mineral soils, from the soil surface to the shallowest of the following:

1. A lithic or petroferric contact; *or*

2. A depth of either 25 cm below a densic or paralithic contact *or* 150 cm below the soil surface, whichever is shallower, if there is a densic or paralithic contact within 150 cm; *or*

3. A depth of 150 cm if the bottom of the deepest diagnostic horizon is less than 150 cm from the soil surface; *or*

4. The lower boundary of the deepest diagnostic horizon *or* a depth of 200 cm, whichever is shallower, if the lower boundary of the deepest diagnostic horizon is 150 cm or more below the soil surface.

C. Organic soils (Histosols), from the soil surface to the shallowest of the following:

1. A lithic or petroferric contact; *or*

2. A depth of 25 cm below a densic or paralithic contact; *or*

3. A depth of 100 cm if depth to permafrost is less than 75 cm; *or*

4. 25 cm below the upper boundary of permafrost, if that boundary is between 75 and 125 cm below the soil surface; *or*

5. The base of the bottom tier.

Application of family and series differentiae

Application of family differentiae

The differentiae of families, like those of the higher categories, can be more readily understood if they are applied to real soils. To demonstrate how the family criteria are determined a rather complex family is used. The Boistfort and Bunker series now make up the medial over clayey, mixed over isotic, mesic family of Alic Fulvudands. A pedon (not the typifying pedon) of the Boistfort series has been sampled and studied in the laboratory (Literature citation: Proceedings of the First International Soil Correlation Meeting 1986). The discussion that follows shows how the classes used as components of the family name are selected. Discussion of differences between the series then follows.

The particle-size class or substitute class is the first component in the name of a family. Before it can be selected, the control section must be known, and before this can be determined we must know what diagnostic horizons and properties are present. The epipedon of a Boistfort soil has andic soil properties and is dark enough, thick enough, and has enough organic carbon for a mollic or an umbric epipedon. The base saturation is less than 6 percent throughout, thus it is an umbric epipedon. The A horizon, lacks the evidence that organic carbon and aluminum have been moved from an eluvial to an illuvial horizon required for spodic materials. It has the required thickness of andic soil properties in the required location (item C. key to soil orders) for the Andisol order. The control section for particle-size is determined using the criteria in item B.(a). The particle-size control section is from 5 (the mineral soil surface) to 105 cm.

The upper part of the particle-size control section, from 5 to 53 cm in the type location, meets the criteria for medial listed in item B.4. in the key to particle-size classes and substitutes for classes. The lower part, from 53 to 105 cm in the type location, meets the criteria for clayey, item D.10. The soil materials meet the requirements for strongly contrasting particle-size classes and this combination, medial over clayey is included as number 42. on the list of classes considered as strongly contrasting.

The control section for mineralogy classes is the same as that used for the particle-size classes. The mineralogy classes are given for both named particle-size classes for families with strongly contrasting particle-size classes, unless the mineralogy classes are the same for both parts. The mineralogy classes are determined using the key to mineralogy classes. Medial is a modifier that replaces the name of particle-size classes. This family is part of the Andisol soil order; thus it fails item A. and meets item B. of the key. Based on the laboratory data this part of the control section has mixed mineralogy. The clayey part fails items A. and B. This layer meets the criteria listed in item C. The isotic class, item C.6., is the first class in the key for which this layer meets all of the criteria. The family mineralogy is mixed over isotic.

Cation exchange activity classes are used only for layers with both mixed or siliceous mineralogy and a clayey, clayey-skeletal, coarse-loamy, coarse-silty, fine, fine-loamy, fine-silty, loamy, loamy-skeletal, or very fine particle-size class. In this family the mixed mineralogy is associated with the medial substitute for a particle-size class and the isotic mineralogy is associated with the clayey particle-size class. Therefore, no cation

exchange activity class is used in this family name.

Calcareous and reaction classes are not used in families of Udands.

The mean soil temperatures estimated from climatic data are mean winter about 3°C (38°F); mean summer about 16°C (60°F); and mean annual soil temperature about 15°C (50°F). These data are within the mesic temperatures class criteria, item A.2., in the key to temperature classes.

The Boistfort and Bunker soils have no root limiting layers within 100 cm. They therefore fail items A. and B. in the key to soil depth classes, but meet criterion C. No depth of soil class is used for soils that meet criterion C.

It can be determined from the keys that families of Andisols do not use rupture resistance classes, classes of coatings (on sands), nor classes of permanent cracks.

The classes that are components of the family name are Medial over clayey, mixed over isotic, and mesic. The family name is medial over clayey, mixed over isotic, mesic Alic Fulvudands.

Application of series differentiae

The standard descriptions of the Boistfort and Bunker series in the family used as an example are given in this chapter. If we compare the descriptions of the typifying pedons of these two series, we note that the particle-size control section of the Bunker soils averages 15 to 35 percent basalt fragments and Boistfort soils average less than 10 percent. These differences are relatively small but reflect differences in setting and parent materials that affect the use of these soils. The Boistfort soils are forming from basalt on the more stable positions on foothills and mountains and the Bunker soils are forming in colluvium from basalt on metastable slopes. These soils are used for the production of lumber. The differences in these soils affect both tree growth and the construction and maintenance of roads needed to harvest the trees.

The Bunker series allows basalt at depths from 100 to more than 150 cm from the mineral soil surface. This range in depth to a lithic contact could be used as a criterion to divide the Bunker series into two series as the lithic contact is within the control section for soil series. Because this depth difference is difficult to separate in mapping and has little effect on the use of these soils for the production of lumber the series is allowed this wide range in soil depth. Many soil series that are in other climates or that have more intensive uses are separated based on having (or not having) a lithic contact between 100 and 150 cm.

This example shows the nature of series differentiae. Mostly, the series within a given family have several small differences in the nature or arrangement of horizons, in the absence of horizons, in the nature of the soil materials in the series control section, or in soil moisture or soil temperature. These differences commonly reflect differences in setting, climate and/or parent materials that have important affects on the use of the soils. These differences permit, but do not require the separation of soil series within a family. The differentiae are discussed under the category of series in chapter 5.

A full treatment of series differentiae within families is beyond the scope of this text. Series differentiae vary among families, subgroups, great groups, and even orders. The principle, however, remains the same. The series are distinguished within a family primarily to facilitate quantitative interpretations of soil behavior.

LOCATION BOISTFORT WA

Established Series
Rev. CJM/RFP/RJE/TLA
12/93

BOISTFORT SERIES

The Boistfort series consists of very deep, well drained soils formed in material weathered from basalt and a component of volcanic ash in the upper part. Boistfort soils are on foothills and mountains and have slopes of 0 to 65 percent. The average annual precipitation is about 230 cm and the average annual temperature is about 10 degrees C.

TAXONOMIC CLASS: Medial over clayey, mixed over isotic, mesic Alic Fulvudands

TYPICAL PEDON: Boistfort silt loam - forested. (Colors are for moist soil unless otherwise stated. All textures are apparent field textures.)

Oi–0 to 5 cm (0 to 2 inches); slightly decomposed twigs, needles, and moss.

A1–5 to 28 cm (2 to 11 inches); dark brown (7.5YR 3/2) silt loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; soft, very friable, slightly sticky and slightly plastic, and weakly smeary; many coarse, medium and fine roots; many medium tubular pores; 25 percent weakly cemented shot-like concretions; very strongly acid; clear wavy boundary. (18 to 30 cm thick)

A2–28 to 53 cm (11 to 21 inches); dark brown (7.5YR 3/2) silty clay loam, dark brown (10YR 4/3) dry; moderate very fine subangular blocky structure; slightly hard, friable, sticky and plastic, and weakly smeary; many coarse, medium and fine roots; many medium tubular pores; few firm shot-like concretions; very strongly acid; clear wavy boundary. (0 to 25 cm thick)

2Bw1–53 to 99 cm (21 to 39 inches); dark brown (7.5YR 4/4) silty clay, yellowish brown (10YR 5/6) dry; weak fine subangular blocky structure; hard, friable, sticky and plastic, and weakly smeary; few fine roots; common medium tubular and interstitial pores; extremely acid; gradual wavy boundary.

2Bw2–99 to 140 cm (39 to 55 inches); strong brown (7.5YR 5/6) silty clay, strong brown (10YR 5/8) dry; weak very fine subangular blocky structure; very hard, friable, sticky and plastic, and weakly smeary; few fine tubular and common medium interstitial pores; extremely acid; clear wavy boundary. (Combined thickness of the 2Bw horizon is 50 to 100 cm)

2BC–140 to 157 cm (55 to 62 inches); strong brown (7.5YR 5/6) silty clay, yellowish brown (10YR 5/6) dry; weak very fine subangular blocky structure; very hard, friable, sticky and plastic, and weakly smeary; few fine tubular and common medium interstitial pores; extremely acid.

TYPE LOCATION: Thurston County, Washington; Capitol State Forest, about 5 miles northwest of Littlerock, 540 meters west

and 180 meters north of the southeast corner of section 24, T. 17 N., R. 4 W.

RANGE IN CHARACTERISTICS: Solum thickness ranges from 100 to more than 150 cm and depth to basalt is more than 150 cm. Rock fragments average less than 10 percent in the particle-size control section. The upper part of the particle-size control section, 5 to 105 cm, has an estimated moist bulk density of 0.75 to 0.90 g/cc, volcanic glass content of 5 to 20 percent, acid-oxalate extractable aluminum plus one-half iron of 1.0 to 2.0 percent, phosphate retention of 85 to 95 percent, and 15 bar water retention of 15 to 20 percent for air dried samples. The upper 2/3 of the control section has less than 4 percent organic carbon in some part. Under forest cover, the mean annual soil temperature is about 10 degrees C. (50 degrees F.) and ranges from 8 to 11 degrees C. The umbric epipedon is 25 to 50 cm thick.

The A horizon has value and chroma of 2 or 3 when rubbed and moist and value and chroma are 2,3, or 4 when dry. This horizon is moderately acid to very strongly acid.

Some pedons have AB and BA horizons.

The 2Bw horizon has hue of 5YR or 7.5YR, value and chroma of 4 through 6 moist, 5 through 8 dry. The apparent field texture averages clay loam, silty clay loam, or silty clay, but in some thin subhorizons it is gravelly or cobbly silty clay loam, gravelly or cobbly clay loam, or gravelly or cobbly silty clay. This horizon is moderately acid to extremely acid.

COMPETING SERIES: These are the Bunker soils. Bunker soils contain 15 to 35 percent rock fragments in the particle-size control section.

GEOGRAPHIC SETTING: Boistfort soils are on stable positions on foothills and mountains. Slopes range from 0 to 65 percent. The soils formed in material weathered from basalt and a component of volcanic ash in the upper part. Elevations range from 30 to 540 meters. These soils are in marine climate with cool wet winters and cool dry summers. Average annual precipitation ranges from 180 to 300 cm. The average January temperature is about 3 degrees F.; average July temperature is about 16 degrees C.; and the average annual temperature is about 10 degrees C. The growing season (-2 degrees C.) is 200 to 240 days.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the competing Bunker soils and the Astoria, Elochoman, Kamila, Lates, Lytell, Murnen, and Zenker soils. Astoria soils are in a fine class and are Umbrepts. Elochoman, Lytell, and Zenker soils are in a medial class, in addition Lytell, and Zenker soils average more than 35 percent pararock fragments, consisting of weathered sandstone or siltstone, in the particle-size control section. Kamila soils are in a medial-skeletal class and have a lithic contact between 50 to 100 cm. Lates and Murnen soils are in medial and a frigid class.

DRAINAGE AND PERMEABILITY: Well drained; slow to moderate runoff; moderate permeability.

USE AND VEGETATION: Forested. Vegetation is mainly Douglas-fir, western redcedar, and red alder with an understory of western swordfern, Oregon-grape, red huckleberry, and vine maple.

DISTRIBUTION AND EXTENT: Southwestern Washington; series is of moderate extent.

SERIES ESTABLISHED: Grays Harbor County (Grays Harbor County Area), Washington, 1970.

REMARKS: Diagnostic horizons and features recognized in this pedon are an umbric epipedon from the mineral surface (at 5 cm) to 53 cm and a cambic horizon from 53 to 157 cm. The upper 48 cm of the particle-size control section has andic soil properties. The ratio of 15 bar water to clay is less than 1.0 and the CEC is less than 150 meq per 100 g clay due to better than "normal" dispersion in one horizon.

ADDITIONAL DATA: Characterization data are available, pedon numbers 84P0906 and 40A3303.

National Cooperative Soil Survey
U.S.A.

LOCATION BUNKER WA

Established Series
Rev. FG/RFP/RJE/TLA
12/93

BUNKER SERIES

The Bunker series consists of deep, well drained soils formed in colluvium weathered from basalt and a component of volcanic ash in the upper part. These soils are on foothills and mountains. Slopes are 1 to 90 percent. The average annual precipitation is about 230 cm and the average annual temperature is about 10 degrees C.

TAXONOMIC CLASS: Medial over clayey, mixed over isotic, mesic Alic Fulvudands

TYPICAL PEDON: Bunker loam - forested. (Colors are for moist soil unless otherwise stated. All textures are apparent field textures.)

Oi--0 to 3 cm (0 to 1 inch); loose slightly decomposed fir needles, twigs and moss.

Oa--3 to 5 cm (1 to 2 inches); decomposed litter; dark red with many white mycelia.

A--5 to 29 cm (2 to 12 inches); dark reddish brown (5YR 3/3) loam, reddish brown (5YR 4/3) dry; moderate fine granular structure; slightly hard, friable, slightly sticky and slightly plastic and weakly smeary; many roots; 15 percent angular basalt pebbles; moderately acid (pH 5.9); clear wavy boundary. (25 to 36 cm thick)

BA--29 to 47 cm (12 to 19 inches); dark reddish brown (5YR 3/4) gravelly clay loam reddish brown (5YR 4/4) dry; moderate medium and fine subangular blocky structure; hard, friable, sticky and plastic and weakly smeary; many roots; 30 percent angular basalt pebbles; few medium and fine shot-like concretions; moderately acid (pH 5.9); clear irregular boundary. (5 to 25 cm thick)

2Bw1--47 to 88 cm (19 to 35 inches); dark reddish brown (5YR 3/4) gravelly clay loam, reddish brown (5YR 4/4) dry; moderate medium and fine subangular blocky structure; hard, firm, sticky and plastic and weakly smeary; common roots; many fine pores; 30 percent angular basalt pebbles; moderately acid (pH 5.8); gradual wavy boundary.

2Bw2--88 to 134 cm (35 to 53 inches); reddish brown (5YR 4/4) clay loam, reddish brown (5YR 5/4) dry; moderate medium subangular blocky structure; slightly hard, firm, sticky and plastic and weakly smeary; many roots; many fine pores; 10 percent angular basalt pebbles; moderately acid (pH 6.0); clear irregular boundary. (Combined thickness of the 2Bw horizon is 50 to 90 cm)

2BC--134 to 156 cm (55 to 62 inches); dark brown (7.5YR 3/4) clay loam, reddish brown (5YR 4/4) dry; weak medium subangular blocky structure; slightly hard, friable, sticky and plastic and weakly smeary; few roots; 10 percent angular basalt pebbles; moderately acid (pH 6.0); clear irregular boundary. (10 to 30 cm thick)

R--156 cm (62 inches); fractured basalt.

TYPE LOCATION: Lewis County, Washington; on logging road number 5 Weyerhaeuser Company McDonald Tree Farm; approximately 570 meters south, 570 meters west of corner sec. 11, T. 12 N., R. 5 W.

RANGE IN CHARACTERISTICS: The mean annual soil temperature ranges from 8 to 11 degrees C. The depth to fractured bedrock ranges from 100 to more than 150 cm from the mineral soil surface. Basalt fragments in the particle-size control section average 15 to 35 percent. The upper part of the particle-size control section (4 to 104 cm) has an estimated moist bulk density of 0.85 to 1.0 g/cc, volcanic glass content of 5 to 20 percent, acid-oxalate extractable aluminum plus one-half iron of 1.0 to 2.0 percent, phosphate retention of 85 to 95 percent, and 15 bar water retention of 15 to 20 percent for air dried samples. Organic carbon is less than 4 percent in some part of the upper 75 cm of the particle-size control section. Reaction ranges from very strongly acid to moderately acid.

The A horizon has hue of 5YR or 7.5YR, value of 2 or 3 moist, 4 or 5 dry, and chroma of 1 to 3 moist, 3 or 4 dry. It has 0 to 15 percent pebbles.

The 2B horizon has hue of 5YR through 10YR, value of 3 or 4 moist, 4 or 5 dry, and chroma of 3 or 4 moist. It ranges from loam to clay loam, silt loam or silty clay loam with 10 to 35 percent rock fragments.

COMPETING SERIES: These are the Boistfort soils. Boistfort soils average 0 to 10 percent basalt fragments in the particle-size control section.

GEOGRAPHIC SETTING: The Bunker soils are on metastable side slopes and foot slopes at elevations of 30 to 660 meters. Slopes are 1 to 90 percent. These soils formed in colluvium weathered from basalt and a component of volcanic ash in the upper part. Winters are cool and moist and summers are warm and dry. The average annual temperature is about 10 degrees C., average January temperature is about 3 degrees C., and average July temperature is about 16 degrees C. Annual precipitation ranges from 180 to 300 cm. The growing season (-2 C.) is 200 to 240 days.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Astoria, Katula, Lytell, Swem, Murnen, Squally, and Zenker soils and the competing Boistfort soils. Astoria soils are Umbrepts and are in a fine class. Katula and Squally soils are in a medial-skeletal class. Lytell and Zenker soils are in a medial class and average more than 35 percent weathered sandstone or siltstone pararock fragments in the particle-size control section. Murnen soils are in a frigid temperatures class. Swem soils are in a medial class and have grayish iron depletions in the particle-size control section.

DRAINAGE AND PERMEABILITY: Well drained; slow to rapid runoff; moderate permeability.

USE AND VEGETATION: Forested. Bunker soils are used for timber production, watershed, wildlife habitat, and recreation. Vegetation is mainly a Douglas-fir and western hemlock with an understory of western swordfern, Oregon-grape, red huckleberry, and vine maple.

DISTRIBUTION AND EXTENT: Southwestern Washington. The soil is extensive.

SERIES ESTABLISHED: Wahkiakum County, Washington, 1976.

REMARKS: Diagnostic horizon and features recognized in this pedon are an umbric epipedon from the mineral surface to 29 cm and a cambic horizon from 29 to 156 cm. The upper 43 cm of the particle-size control section has andic soil properties. Thickness and chroma range outside taxonomic limits for Fulvudands, however organic carbon is greater than 6 percent to 30 or more centimeters. A proposal is being made (12/93) to drop the color criteria for Fulvudands.

ADDITIONAL DATA: The classification is based on laboratory data taken on the Boistfort series and are available at the National Soil Survey Laboratory, Lincoln, Nebraska: Sample S77WA25-2 and 84P-906. Partial data are available on the Bunker series laboratory number S76WA-27-1.

National Cooperative Soil Survey
U.S.A."

615.160 Fragipan Amendment

Page 42; Delete entire section "Fragipan" and insert the following:

"**Fragipan**

A fragipan (modified from L. *fragilis*, brittle, and pan; meaning brittle pan) is an altered subsurface horizon, 15 cm or more thick, that restricts the entry of water and roots into the soil matrix. It may, but does not necessarily, underlie an argillic, cambic, albic, or spodic horizon. It is commonly within an argillic horizon, but some are within an albic horizon. The fragipan has strongly developed fragic properties (defined below). Commonly it has a relatively low content of organic matter and a high bulk density relative to the horizons above it. The fragipan has a hard or harder rupture resistance class, when dry. When moist, it has a brittle manner of failure in 60 percent or more of the volume. This is the tendency for a ped or clod to rupture suddenly rather than to undergo slow deformation when pressure is applied. Air dried fragments slake when submerged in water. Most fragipans have redoxomorphic features, have evidence of translocation of clay, and are slowly or very slowly permeable to water. Some fragipans consist of albic materials (defined below). Most fragipans are either massive or have very coarse prismatic structure. Many have bleached, roughly vertical faces or borders of prisms that look like seams in vertical cross section. The seams commonly have less clay in the upper part than in the

lower part. They form a polygonal pattern in horizontal cross section (plates 6A and 6B). Plate 6A shows a soil in which the fragipan has an upper boundary at a depth of about 60 cm. Plate 6B shows a horizontal cross section through the fragipan. Pedon 34 is an example of another soil in which the fragipan is a bit deeper. Most commonly, a fragipan has an abrupt or clear upper boundary at a depth of 50 to 100 cm below the original soil surface. Thickness ranges from about 15 to 200 cm, and commonly the lower boundary is gradual or diffuse. A fragipan is virtually free of roots except in the bleached seams and on faces of prisms. It should be noted that in many fragipans the bleached materials are not brittle when moist although, if clayey, they may be hard when dry. Clay films are on the faces of peds and bodies or pore fillings of oriented clay are in the matrix of most fragipans. Fragipans consisting of albic materials commonly do not have bodies of oriented clay.

Most fragipans have very coarse prismatic structure. Some have weak to strong, thick platy or lenticular structure within the prisms. In others, the secondary structure is more nearly weak coarse blocky than platy. Some have transitional structure between platy and blocky. Some fragipans have no secondary structure and some appear to be massive. The spacing of any separations or bleached seams between the structural units, that allow the entry of roots, averages 10 cm or more on the horizontal dimensions.

Genesis

The genesis of fragipans is obscure (Grossman and Carlisle 1969). The formation of the density and brittleness of a fragipan has been variously attributed to physical ripening, the weight of glaciers, permafrost processes, and other events during the Pleistocene. Some of the properties of some fragipans are inherited from buried paleosols. The authors cited in the review however, all consider fragipans to be pedogenic soil horizons, regardless of whether the density and brittleness are pedogenic or not, on the following evidence:

1. Fragipans have evidence of pedogenesis, other than density and brittleness, including one or more of the following: Oriented clay in the matrix or on faces of peds; Albic materials or coats of albic materials on faces of peds or in seams; Soil structure and redoxomorphic features in the matrix or on faces of peds.

2. Within its range of occurrence, the fragipan is roughly parallel to the soil surface.

3. The upper boundary of most fragipans is about 50 to 100 cm below the surface, if the soil is not eroded. This range in depth has been observed in northern Michigan, in southern Mississippi, in New Zealand, in Scotland, and in Italy. The extreme range in depth from the surface in soils that have not been eroded or buried seems to be from about 25 to 150 cm. This would be a remarkable accident if the fragipans were not soil horizons.

4. The pans occur in alluvium, loess, residuum from bedrock, glacial lacustrine deposits, till, and solifluction materials. The common properties of the parent materials are a loamy texture, a low carbonate content or no carbonates, and an appreciable content of silt or very fine sand.

5. The pans underlie a variety of horizons, including spodic, argillic, cambic, and albic horizons. In most instances the morphology of the fragipan is similar. Fragipans are not known to occur in materials that are calcareous, nor do they underlie horizons with a k, y, or z suffix, even if these horizons are weakly developed. If the fragipans are not soil horizons, the failure to find them under horizons with k, y, or z suffixes would be another remarkable accident. Fragipans form only in soils in which water moves downward through the soil. They are at depths which rarely freeze.

6. If a soil has an E' and a B't horizon, the fragipan may be in the lower argillic horizon or even in the eluvial horizon that separates the two B horizons. Thus, it occurs in otherwise eluvial or illuvial horizons.

7. Fragipans are only known to occur in soils formed under forest vegetation.

The authors believe that the polygonal network of bleached materials is formed by reduction of free iron after water has saturated the cracks. The bleached materials commonly are bounded by a thin zone in which iron has been concentrated. Other things being equal, the structural units are smallest in the finest textured materials. For a given texture, structure tends to be larger if the dry season is short or mild than if it is long or intense. Structural units, with bleached surfaces, are rare or absent in the coarsest textured materials.

If an argillic horizon overlies a fragipan, movement of clay down the faces of structural units usually is indicated by relatively thick clay films.

Examination of interiors of the prisms shows close packing of the mineral grains and bodies of oriented clay. The close packing is consistent with the high bulk density of the fragipan relative to the density of the overlying horizons.

The hardness of the fragipan when dry is largely attributed to the close packing and to binding by clay. However, binding by clay alone does not account for the brittleness of the pan when it is moist. The brittleness may be due to weak chemical binding by one or more agents, not necessarily the same in all kinds of soil. The higher pH of the fragipan that underlies a spodic horizon suggests some consistent difference. Hydrogen bonding with silica and with aluminum have been suggested in the literature. One piece of field evidence supporting the hypothesis of weak chemical binding is that one can find fragipans in which the brittleness appears to have been partly or completely destroyed. Some very old arable fields in Belgium have no fragipan, however they retain the color pattern, although a weak fragipan is present in adjacent fields. The patterns of polygonal bleaching can be very well developed, but the brittleness may be observable in only a small part of the horizon near the centers of the prisms. Fine feeder roots ramify the nonbrittle parts of the prisms. The amount of nonbrittle materials ranges from none to well over two-thirds of the volume of the horizon. A second piece of field evidence for weak chemical binding is that fragipans generally seem more stable when exposed in banks than either the overlying horizons or the underlying materials. The overlying and underlying materials commonly slump in the exposures and the fragipan protrudes. Figure 2 shows this kind of bulge in a roadcut in New Zealand. There, the bleached materials on the sides of the prisms are commonly washed out by the rain exposing the brittle parts as

separated prisms. At this time the evidence about the cause of the brittleness is conflicting.

Where a fragipan formed in till, its relatively high bulk density may be attributed partly to the weight of the glaciers, desiccation processes (physical ripening), or to consolidation within a layer of permafrost. Yet, many if not all of the fragipans seem to reflect the influence of other factors. One factor is presumed to be pressure generated by the very slight shrinking and swelling. When dry, a pan normally has very fine cracks between the prisms, and very fine sand, silt, and clay might be washed into these cracks when the dry season ends. Roots growing along the sides of the prisms add to the bulk. Then, when the pan is remoistened, it swells very slightly. The force of swelling, however, is opposed by the materials that have moved into the cracks between the prisms and by the weight of the soil above. The internal pressure thus generated may be responsible for part of the compaction. A second factor is the inertness of the pan. Swelling and shrinking produce little soil movement. Soil fauna seem to be absent, and roots, restricted to the bleached zones between the prisms, are mostly oriented vertically and do not lift the soil as they grow. The pressure generated by the growth of the woody tree roots is lateral, not vertical. The common flattened shape of the roots attests to the pressure. Freezing and thawing are also minimal. Under the native vegetation it is doubtful that many fragipans ever freeze because of their depth and because they are insulated by the O horizons and by snow.

Significance to soil classification

Any continuous horizon that impedes movement of water and growth of roots is important to soil classification--particularly for interpretations of soils for plant growth and for engineering manipulations. Water stands above the pan in a level soil and moves laterally along the top of the pan if the soil is sloping. Even though the processes that produce the fragipans are imperfectly known, these pans are restricted in their climatic range and the natural vegetation and are believed to be genetic.

Identification

First, a fragipan has a combination of properties that restrict the penetration of roots and water from 60 percent or more of the volume of the horizon. Roots are restricted except in nearly vertical zones that form the boundaries between very coarse structural units. The structural units are commonly polyhedral in horizontal cross section and average 10 cm or more across. Material within the structural units is massive, platy, or has weak blocky structure, a firm or firmer consistence, and a brittle manner of failure at or near field capacity. Some fragipans are massive and are restrictive throughout the horizon.

Second, a fragipan has evidence of pedogenesis, in addition to density and brittleness. This evidence, in the matrix, on faces of peds, or in seams, is in the form of bodies of oriented clay, clay films, albic materials, and/or both redoxomorphic features and soil structure. The evidence of pedogenesis is needed to separate the fragipan from dense parent materials (densic materials) such as dense till and volcanic mudflow material.

Third, a fragipan must have a minimum thickness. A thickness of 15 cm or more is thought to be thick enough to impart the interpretations for plant growth and for engineering manipulations and to separate the fragipan from plow pans or other compacted surface or near surface layers.

Fourth, air-dry fragments of the natural soil fabric, 5 to 10 cm in diameter, from more than 50 percent of the horizon slake when they are submerged in water. This property separates fragipans from duripans and other cemented horizons.

Pedon 34 illustrates a soil that has a fragipan below an argillic horizon. The pan is relatively deep and has its upper boundary at a depth of about 94 cm and its lower boundary at about 150 cm.

Pedon 35 illustrates a wet soil in which a fragipan lies below an argillic horizon. In this soil there is lithologic discontinuity in the parent materials at a depth of 53 cm. The upper mantle is presumed to be Wisconsinan loess. The fragipan developed in the surface horizons of a very old soil that developed in coastal plain sediments. It is very common that a fragipan develops in the former surface horizons of these buried soils, if the burial is not more than about 80 cm.

Soils in the United States that have a small amount of plinthite normally are brittle in at least some parts of the horizons that contain the plinthite. Some of these horizons meet the requirements for a fragipan but, in addition have the plinthite. At this stage of knowledge, it is not clear that such horizons should be considered fragipans, but where they are at depths comparable to those of fragipans in other soils, the effects on plants and on engineering uses of the soils are the same. For pragmatic reasons, therefore, such horizons that have an upper boundary within a depth of 100 cm below the mineral soil surface, are considered fragipans.

Summary of properties

To be identified as a fragipan a layer must have all of the following characteristics:

1. The layer is 15 cm or more thick; *and*

2. It has evidence of pedogenesis within the horizon or, at a minimum, on the faces of structural units; *and*

3. It has very coarse prismatic, columnar, or blocky structure of any grade, has weak structure of any size, or is massive. Separations between structural units that allow roots to enter have an average spacing of 10 cm or more on the horizontal dimensions; *and*

4. Air-dry fragments of the natural soil fabric, 5 to 10 cm in diameter, from more than 50 percent of the horizon slake when they are submerged in water; *and*

5. It has, in 60 percent or more of the volume, a firm or firmer consistence, a brittle manner of failure at or near field capacity, and roots virtually absent."

Page 49; Following the section on "Durinodes", insert the following:

"Fragic Soil Properties

Fragic soil properties are similar to the essential properties of the *fragipan*. They have neither the layer thickness nor volume requirements of the fragipan. Fragic soil

properties are in subsurface horizons, although they can be at or near the surface in truncated soils. Aggregates with fragic soil properties have a firm or firmer consistence and a brittle manner of failure when soil water is at or near field capacity. Air-dry fragments of the natural fabric, 5 to 10 cm in diameter slake when they are submerged in water. Aggregates with fragic soil properties have evidence of pedogenesis, including one or more of the following: Oriented clay within the matrix or on faces of peds; Redoxomorphic features within the matrix or on faces of peds; Strong or moderate soil structure; And coatings of albic materials or uncoated silt and sand grains on faces of peds or in seams. Peds with these properties are considered to have fragic soil properties regardless of whether the density and brittleness are pedogenic or not.

Soil aggregates with fragic soil properties must:

1. Have evidence of pedogenesis within the aggregates or at a minimum, on the faces of the aggregates; *and*

2. Slake when air-dry fragments of the natural fabric, 5 to 10 cm in diameter, are submerged in water; *and*

3. Have a firm or firmer consistence and a brittle manner of failure when soil water is at or near field capacity; *and*

4. Restrict the entry of roots into the matrix when soil water is at or near field capacity."

Page 109, item HAE. (changed to IAD.); Change to read:

"IAD. Other Aqualfs that have a fragipan with its upper boundary within 100 cm of the mineral soil surface.

Fragiaqualfs"

NSTH 615.89, p. 615-428; Following item IAJA. (changed to IAK. above) add the new items IAKB. and IAKC. and renumber items IAKB. through IAKG. to IAKD. through IAKI.:

"IAKB. Other Endoaqualfs that have:

1. Fragic soil properties;

a. In 30 percent or more of the volume of a layer 15 cm or more thick that has its upper boundary within 100 cm of the mineral soil surface; *or*

b. In 60 percent or more of the volume of a layer 15 cm or more thick; and

2. Have, in one or more horizons between the A or Ap horizon and a depth of 75 cm below the mineral soil surface, in 50 percent or more of the matrix, one, or a combination, of the following colors:

a. Hue of 7.5YR or redder; *and*

(1) Peds present and a chroma of 2 or more (both moist and dry) on 50 percent or more of ped exteriors, *or* no redox depletions with a chroma of 2 or less (both moist and dry) in ped interiors; *or*

(2) No peds present and a chroma of 2 or more (both moist and dry); *or*

b. Hue of 10YR or yellower *and either*

(1) Both a color value, moist, and chroma of 3 or more (both moist and dry); *or*

(2) A chroma of 2 or more (both moist and dry) and no redox concentrations.

Aeric Fragic Endoaqualfs"

"IAKC. Other Endoaqualfs that have fragic soil properties;

1. In 30 percent or more of the volume of a layer 15 cm or more thick that has its upper boundary within 100 cm of the mineral soil surface; *or*

2. In 60 percent or more of the volume of a layer 15 cm or more thick; and

Fragic Endoaqualfs"

NSTH 615.89, p. 615-429; Following item 4. of the definition of Typic Endoaqualfs add item 5. as follows:

"5. Have fragic soil properties:

a. In less than 30 percent of the volume of all layers 15 cm or more thick that have the upper boundary within 100 cm of the mineral soil surface; *and*

b. In less than 60 percent of the volume of all layers 15 cm or more thick."

NSTH 615.89, p. 615-430; Following item IAIB. (Aquandic Epiaqualfs, changed to IAJE. above) add the new items IAJF. and IAJG. and renumber items IAJF. through IAJM. to IAJH. through IAJO.:

"IAJF. Other Epiaqualfs that have:

1. Fragic soil properties;

a. In 30 percent or more of the volume of a layer 15 cm or more thick that has its upper boundary within 100 cm of the mineral soil surface; *or*

b. In 60 percent or more of the volume of a layer 15 cm or more thick; and

2. Have, in one or more horizons between the A or Ap horizon and a depth of 75 cm below the mineral soil surface, in 50 percent or more of the matrix, one, or a combination, of the following colors:

a. Hue of 7.5YR or redder; *and*

(1) Peds present and a chroma of 2 or more (both moist and dry) on 50 percent or more of ped exteriors, *or* no redox depletions with a chroma of 2 or less (both moist and dry) in ped interiors; *or*

(2) No peds present and a chroma of 2 or more (both moist and dry); *or*

b. Hue of 10YR or yellower *and either*

(1) Both a color value, moist, and chroma of 3 or more (both moist and dry); *or*

(2) A chroma of 2 or more (both moist and dry) and no redox concentrations.

Aeric Fragic Epiaqualfs

IAJG. Other Epiaqualfs that have fragic soil properties;

1. In 30 percent or more of the volume of a layer 15 cm or more thick that has its upper boundary within 100 cm of the mineral soil surface; *or*

2. In 60 percent or more of the volume of a layer 15 cm or more thick; and

Fragic Epiaqualfs"

NSTH 615.89, p. 615-431; Following item 5. of the definition of Typic Epiaqualfs add item 6. as follows:

"6. Have fragic soil properties:

a. In less than 30 percent of the volume of all layers 15 cm or more thick that have the upper boundary within 100 cm of the mineral soil surface; *and*

b. In less than 60 percent of the volume of all layers 15 cm or more thick."

NSTH 615.62, p. 615-211; Following item IAFB. (changed to IAGC. above) add the new items IAGC. and IAGD. and renumber items IAGC. through IAGE. to IAGE. through IAGG.:

"IAGC. Other Glossaqualfs that have:

1. Fragic soil properties;

a. In 30 percent or more of the volume of a layer 15 cm or more thick that has its upper boundary within 100 cm of the mineral soil surface; *or*

b. In 60 percent or more of the volume of a layer 15 cm or more thick; and

2. Have, in one or more horizons between the A or Ap horizon and a depth of 75 cm below the mineral soil surface, in 50 percent or more of the matrix, one, or a combination, of the following colors:

a. Hue of 7.5YR or redder; *and*

(1) Peds present and a chroma of 2 or more (both moist and dry) on 50 percent or more of ped exteriors, *or* no redox depletions with a chroma of 2 or less (both moist and dry) in ped interiors; *or*

(2) No peds present and a chroma of 2 or more (both moist and dry); *or*

b. Hue of 10YR or yellower *and either*

(1) Both a color value, moist, and chroma of 3 or more (both moist and dry); *or*

(2) A chroma of 2 or more (both moist and dry) and no redox concentrations.

Aeric Fragic Glossaqualfs

IAGD. Other Glossaqualfs that have fragic soil properties;

1. In 30 percent or more of the volume of a layer 15 cm or more thick that has its upper boundary within 100 cm of the mineral soil surface; *or*

2. In 60 percent or more of the volume of a layer 15 cm or more thick; and

Fragic Glossaqualfs"

NSTH 615.62, p. 615-211; Following item 3. of the definition of Typic Glossaqualfs add item 4. as follows:

"4. Have fragic soil properties:

a. In less than 30 percent of the volume of all layers 15 cm or more thick that have the upper boundary within 100 cm of the mineral soil surface; *and*

b. In less than 60 percent of the volume of all layers 15 cm or more thick."

NSTH 615.38 p. 615-59 definition of Kandiaqualfs; In item 1. delete final word "and", in item 2 delete word "fragipan", add final word "and", and add new item 3. to read:

"3. Do not have a fragipan with its upper boundary within 100 cm of the mineral soil surface."

NSTH 615.38 p. 615-62 definition of Kandiudalfs item 4.; Delete final words " or fragipan", renumber items 5. and 6. as 6. and 7., and add new item 5. to read:

"5. Do not have a fragipan with its upper boundary within 100 cm of the mineral soil surface;"

NSTH 615.38 p. 615-63 definition of Kanhapludalfs item 3.; Delete final words " or a fragipan", renumber items 4. and 5. as 5. and 6., and add new item 4. to read:

"4. Do not have a fragipan with its upper boundary within 100 cm of the mineral soil surface;"

Page 134 column 1, line 9, item 2. (changed to item 1.); Delete final words " or a fragipan", renumber items 2. through 4. as 3. and 5., and add new item 2. to read:

"2. Do not have a fragipan with its upper boundary within 100 cm of the mineral soil surface;"

NSTH 615.89 p. 615-428, column 1, line 34; item 3.; Delete the words "fragipan," and "and", renumber item 4. as 5. and add new item 4. to read:

"4. Do not have a fragipan with its upper boundary within 100 cm of the mineral soil surface; and"

NSTH 615.89 p. 615-429 column 2, line 28; item 3.; delete the words "fragipan," and "and", renumber item 4. as 5. and add new item 4. to read:

"4. Do not have a fragipan with its upper boundary within 100 cm of the mineral soil surface; and"

Page 112, column 1, line 2 after "fragipan" add:

" with its upper boundary within 100 cm of the mineral soil surface"

Page 119, Change item HBB. (changed to IBB) to read:

"IBB. Other Boralfs that have a fragipan with its upper boundary within 100 cm of the mineral soil surface.

Fragiboralfs"

Page 122, column 2, line 35; Change item 1. to read:

"1. Have, with its upper boundary within 100 cm of the mineral soil surface, a fragipan in or below the argillic horizon;"

NSTH 615.62, p 615-217, following item IBED. (Aquic Arenic Eutroboralfs, changed to IBEF. above); Add the following new item and renumber items IBEG. through IBEM. as IBEH. through IBEN.:

"IBEG. Other Eutroboralfs that have *both*:

1. Fragic soil properties:

a. In 30 percent or more of the volume of a layer 15 cm or more thick that has its upper boundary within 100 cm of the mineral soil surface; *or*

b. In 60 percent or more of the volume of a layer 15 cm or more thick; *and*

2. Redox depletions with a chroma of 2 or less in layers that also have aquic conditions in most years (or artificial drainage) *either*:

a. Within the upper 25 cm of the argillic horizon if its upper boundary is within 50 cm of the mineral soil surface; *or*

b. Within 75 cm of the mineral soil surface if the upper boundary of the argillic horizon is 50 cm or more below the mineral soil surface.

Fragiaquic Eutroboralfs"

NSTH 615.89, p 615-435, following item IBEG. (Oxyaquic Eutroboralfs, changed to IBEN. above); Add the following new item and renumber items IBEN. through IBET. as IBEP. through IBEV.:

"IBEO. Other Eutroboralfs that have fragic soil properties:

1. In 30 percent or more of the volume of a layer 15 cm or more thick that has its upper boundary within 100 cm of the mineral soil surface; *or*

2. In 60 percent or more of the volume of a layer 15 cm or more thick.

Fragic Eutroboralfs"

NSTH 615.62, p. 615-217; Following item 7. of the definition of Typic Eutroboralfs add item 8. as follows:

"8. Have fragic soil properties:

a. In less than 30 percent of the volume of all layers 15 cm or more thick that have the upper boundary within 100 cm of the mineral soil surface; *and*

b. In less than 60 percent of the volume of all layers 15 cm or more thick."

NSTH 615.62, p 615-218, following item IBFC. (Vitrandic Glossoboralfs); Add the following new item and renumber items IBFD. and IBFE. as IBFE. and IBFF.:

"IBFD. Other Glossoboralfs that have *both*:

1. Fragic soil properties:

a. In 30 percent or more of the volume of a layer 15 cm or more thick that has its upper boundary within 100 cm of the mineral soil surface; *or*

b. In 60 percent or more of the volume of a layer 15 cm or more thick; *and*

2. Redox depletions with a chroma of 2 or less in layers that also have aquic conditions in most years (or artificial drainage) *either*:

a. Within the upper 25 cm of the argillic horizon if its upper boundary is within 50 cm of the mineral soil surface; *or*

b. Within 75 cm of the mineral soil surface if the upper boundary of the argillic horizon is 50 cm or more below the mineral soil surface.

Fragiaquic Glossoboralfs"

NSTH 615.89, p 615-435, following item IBFE. (Oxyaquic Glossoboralfs changed to IBFF. above); Add the following new item IBFG. and renumber items IBFF. through IBFJ. as IBFH. through IBFL.:

"IBFG. Other Glossoboralfs that have fragic soil properties:

1. In 30 percent or more of the volume of a layer 15 cm or more thick that has its upper boundary within 100 cm of the mineral soil surface; *or*

2. In 60 percent or more of the volume of a layer 15 cm or more thick.

Fragic Glossoboralfs"

NSTH 615.62, p. 615-219; Following item 5. of the definition of Typic Glossoboralfs add item 6. as follows:

"6. Have fragic soil properties:

a. In less than 30 percent of the volume of all layers 15 cm or more thick that have the upper boundary within 100 cm of the mineral soil surface; *and*

b. In less than 60 percent of the volume of all layers 15 cm or more thick."

Page 125; Change items HEE. AND HEF. (changed to IED. and IEF.) to read:

"IED. Other Udalfs that have a glossic horizon and have a fragipan with its upper boundary within 100 cm of the mineral soil surface.

Fraglossudalfs

IEF. Other Udalfs that have a fragipan with its upper boundary within 100 cm of the mineral soil surface.

Fragiudalfs"

Page 126, column 2, line 22; Change item 1. to read:

"1. Have a fragipan with its upper boundary within 100 cm of the mineral soil surface;"

NSTH 615.47, p 615-161; Change item 2. to read:

"2. Have a fragipan with its upper boundary within 100 cm of the mineral soil surface;"

NSTH 615.62, p 615-221; Delete item IEDA. (renumbered as IEEA.), renumber items IEDB. through IEDD as IEEA. through IEEC., and add the following new item IEED.:

"IEED. Other Glossudalfs that have *both*:

1. Fragic soil properties:

a. In 30 percent or more of the volume of a layer 15 cm or more thick that has its upper boundary within 100 cm of the mineral soil surface; *or*

b. In 60 percent or more of the volume of a layer 15 cm or more thick; *and*

2. Redox depletions with a chroma of 2 or less in layers that also have aquic conditions in most years (or artificial drainage) *either*:

a. Within the upper 25 cm of the argillic horizon if its upper boundary is within 50 cm of the mineral soil surface; *or*

b. Within 75 cm of the mineral soil surface if the upper boundary of the argillic horizon is 50 cm or more below the mineral soil surface.

Fragiaquic Glossudalfs"

NSTH 615.89, p 615-435, following item IEDF. (Oxyaquic Glossudalfs changed to IEEF.); Add the following new item IEEG. and renumber items IEDG. through IEDI. as IEEH. through IEEJ.:

"IEEG. Other Glossudalfs that have fragic soil properties:

1. In 30 percent or more of the volume of a layer 15 cm or more thick that has its upper boundary within 100 cm of the mineral soil surface; *or*

2. In 60 percent or more of the volume of a layer 15 cm or more thick.

Fragic Glossudalfs"

NSTH 615.62, p 615-222, (definition of Typic Glossudalfs), column 1; Following item 3. add:

"4. Do not have fragic soil properties:

a. In 30 percent or more of the volume of a layer 15 cm or more thick that has its upper boundary within 100 cm of the mineral soil surface; *nor*

b. In 60 percent or more of the volume of a layer 15 cm or more thick."

NSTH 615.62, p 615-222, following item IEKE. (renumbered as IEKI.); Add the following new items IEKJ. and IEKK. and renumber items IEKJ. through IEKR. (Oxyaquic Hapludalfs) as IEKL. through IEKT.:

"IEKJ. Other Hapludalfs that have *both*:

1. Fragic soil properties:

a. In 30 percent or more of the volume of a layer 15 cm or more thick that has its upper boundary within 100 cm of the mineral soil surface; *or*

b. In 60 percent or more of the volume of a layer 15 cm or more thick; *and*

2. Redox depletions with a chroma of 2 or less in layers that also have aquic conditions in most years (or artificial drainage) *either*:

a. Within the upper 25 cm of the argillic horizon if its upper boundary is within 50 cm of the mineral soil surface; *or*

b. Within 75 cm of the mineral soil surface if the upper boundary of the argillic horizon is 50 cm or more below the mineral soil surface.

Fragiaquic Hapludalfs

IEKK. Other Hapludalfs that have *both*:

1. Fragic soil properties:

a. In 30 percent or more of the volume of a layer 15 cm or more thick that has its upper boundary within 100 cm of the mineral soil surface; *or*

b. In 60 percent or more of the volume of a layer 15 cm or more thick; *and*

2. Saturation with water, in one or more layers within 100 cm of the mineral soil surface, for 1 month or more per year in 6 or more out of 10 years.

Fragic Oxyaquic Hapludalfs"

NSTH 615.89, p 615-440, following item IEKQ. (Oxyaquic Hapludalfs changed to IEKT. above); Add the following new item IEKU. and renumber items IEKU. through IEKZa. as IEKV. through IEKZd.:

"IEKU. Other Hapludalfs that have fragic soil properties:

1. In 30 percent or more of the volume of a layer 15 cm or more thick that has its upper boundary within 100 cm of the mineral soil surface; *or*

2. In 60 percent or more of the volume of a layer 15 cm or more thick.

Fragic Hapludalfs"

NSTH 615.62, p 615-224, (definition of Typic Hapludalfs), column 2; Following item 11. add:

"12. Do not have fragic soil properties:

a. In 30 percent or more of the volume of a layer 15 cm or more thick that has its upper boundary within 100 cm of the mineral soil surface; *nor*

b. In 60 percent or more of the volume of a layer 15 cm or more thick."

NSTH 615.62, p 615-226, following item IEIA. (Vertic Paleudalfs); Add the following new item IEIC. and renumber items IEIC. through IEIH. (Oxyaquic Paleudalfs) as IEID. through IEII.:

"IEIC. Other Paleudalfs that have *both*:

1. Fragic soil properties:

a. In 30 percent or more of the volume of a layer 15 cm or more thick that has its upper boundary within 100 cm of the mineral soil surface; *or*

b. In 60 percent or more of the volume of a layer 15 cm or more thick; *and*

2. Redox depletions with a chroma of 2 or less in layers that also have aquic conditions in most years (or artificial drainage) *either*:

a. Within the upper 25 cm of the argillic horizon if its upper boundary is within 50 cm of the mineral soil surface; *or*

b. Within 75 cm of the mineral soil surface if the upper boundary of the argillic horizon is 50 cm or more below the mineral soil surface.

Fragiaquic Paleudalfs"

NSTH 615.89, p 615-442, following item IEIG. (Oxyaquic Paleudalfs changed to IEIH. above); Add the following new item IEII. and renumber items IEII. through IEIR. as IEIJ. through IEIT.:

"IEII. Other Paleudalfs that have fragic soil properties:

1. In 30 percent or more of the volume of a layer 15 cm or more thick that has its upper boundary within 100 cm of the mineral soil surface; *or*

2. In 60 percent or more of the volume of a layer 15 cm or more thick.

Fragic Paleudalfs"

NSTH 615.62, p 615-228, (definition of Typic Paleudalfs), column 1; Following item 9. add:

"10. Do not have fragic soil properties:

a. In 30 percent or more of the volume of a layer 15 cm or more thick that has its upper boundary within 100 cm of the mineral soil surface; *nor*

b. In 60 percent or more of the volume of a layer 15 cm or more thick."

NSTH 615.04, p. 615-6; Change item HDC. (changed to IDC.) to read:

"IDC. Other Xeralfs that have a fragipan with its upper boundary within 100 cm of the mineral soil surface.

Fragixeralfs"

NSTH 615.04, p. 615-6; Change item 1. to read:

"1. Have a fragipan with its upper boundary within 100 cm of the mineral soil surface;"

NSTH 615.04, p. 615-8; item (g); Rewrite item 1., and add new item 2. as follows, and renumber item 2. through 4. as 3. through 5.:

"1. Have an argillic horizon, but do not have a natric horizon;

2. Do not have a duripan nor a fragipan with its upper boundary within 100 cm of the mineral soil surface;"

NSTH 615.62, p 615-238, following item IDGF. (Vitrandic Haploxeralfs, changed to IDGG.); Add the following new item IDGH. and renumber items IDGH. through IDGJ. as IDGI. through IEIK.:

"IDGH. Other Haploxeralfs that have *both*:

1. Fragic soil properties:

a. In 30 percent or more of the volume of a layer 15 cm or more thick that has its upper boundary within 100 cm of the mineral soil surface; *or*

b. In 60 percent or more of the volume of a layer 15 cm or more thick; *and*

2. Redox depletions with a chroma of 2 or less in layers that also have aquic conditions in most years (or artificial drainage) *either*:

a. Within the upper 25 cm of the argillic horizon if its upper boundary is within 50 cm of the mineral soil surface; *or*

b. Within 75 cm of the mineral soil surface if the upper boundary of the argillic horizon is 50 cm or more below the mineral soil surface.

Fragiaquic Haploxeralfs"

NSTH 615.62, p 615-238, following item IDGI. (Natric Haploxeralfs, changed to IDGK. above); Add the following new item IDGL. and renumber items IDGL. through IDGS. as IDGM. through IEIT.:

"IDGL. Other Haploxeralfs that have fragic soil properties:

1. In 30 percent or more of the volume of a layer 15 cm or more thick that has its upper boundary within 100 cm of the mineral soil surface; *or*

2. In 60 percent or more of the volume of a layer 15 cm or more thick.

Fragic Haploxeralfs"

NSTH 615.62, p 615-239, (definition of Typic Haploxeralfs), column 1; Following item 11. add:

"12. Have fragic soil properties:

a. In less than 30 percent of the volume of all layers 15 cm or more thick that have the upper boundary within 100 cm of the mineral soil surface; *and*

b. In less than 60 percent of the volume of all layers 15 cm or more thick."

NSTH 615.62, p 615-239, following item IDFC. (Vitrandic Palexeralfs, changed to IDFD.); Add the following new item IDFE. and renumber items IDFE. through IDFJ. as IDFF. through IDFK.:

"IDFE. Other Palexeralfs that have *both*:

1. Fragic soil properties:

a. In 30 percent or more of the volume of a layer 15 cm or more

thick that has its upper boundary within 100 cm of the mineral soil surface; *or*

b. In 60 percent or more of the volume of a layer 15 cm or more thick; *and*

2. Redox depletions with a chroma of 2 or less in layers that also have aquic conditions in most years (or artificial drainage) *either*:

a. Within the upper 25 cm of the argillic horizon if its upper boundary is within 50 cm of the mineral soil surface; *or*

b. Within 75 cm of the mineral soil surface if the upper boundary of the argillic horizon is 50 cm or more below the mineral soil surface.

Fragiaquic Palexeralfs"

NSTH 615.62, p 615-240, following item IDFG. (Natric Palexeralfs, changed to IDFK. above); Add the following new item IDFL. and renumber items IDFK. through IDFP. as IDFM. through IEFR.:

"IDFL. Other Palexeralfs that have fragic soil properties:

1. In 30 percent or more of the volume of a layer 15 cm or more thick that has its upper boundary within 100 cm of the mineral soil surface; *or*

2. In 60 percent or more of the volume of a layer 15 cm or more thick.

Fragic Palexeralfs"

NSTH 615.62, p 615-240, (definition of Typic Palexeralfs), column 2; Following item 11. add:

"12. Do not have fragic soil properties:

a. In 30 percent or more of the volume of a layer 15 cm or more thick that has its upper boundary within 100 cm of the mineral soil surface; *nor*

b. In 60 percent or more of the volume of a layer 15 cm or more thick."

Page 151, column 2, item 2.; Rewrite as follows:

"2. Do not have a duripan or a fragipan with its upper boundary within 100 cm of the mineral soil surface;"

Page 236, column 2, item IAD. (changed to JAD.); Revise to read:

"JAD. Other Aquepts that have a fragipan with its upper boundary within 100 cm of the mineral soil surface.

Fragiaquepts"

Page 238, column 1, line 32; Change item 2. to read:

"2. Do not have a fragipan with its upper boundary within 100 cm of the mineral soil surface;"

Page 239, column 2, line 45; Change item 1. to read:

"1. Have a fragipan with its upper boundary within 100 cm of the mineral soil surface;"

NSTH 615.89 p. 615-475 column 2, last line; Change item 1. to read:

"1. Do not have a fragipan with its upper boundary within 100 cm of the mineral soil surface;"

NSTH 615.89, p. 615-476, following item JAJD.; Add new item JAJD. and renumber items JAJD. through JAJH. to JAJE. through JAJI.:

"JAJD. Other Endoaquepts that have fragic soil properties:

1. In 30 percent or more of the volume of a layer 15 cm or more thick that has its upper boundary within 100 cm of the mineral soil surface; *or*

2. In 60 percent or more of the volume of a layer 15 cm or more thick.

Fragic Endoaquepts"

NSTH 615.89 p. 615-477 column 2, line 29; Change item 1. to read:

"1. Do not have a fragipan with its upper boundary within 100 cm of the mineral soil surface;"

NSTH 615.89, p. 615-477, column 2, following item 6. (definition of Typic Endoaquepts); Add item 7. as follows:

"7. Have fragic soil properties:

a. In less than 30 percent of the volume of all layers 15 cm or more thick that have the upper boundary within 100 cm of the mineral soil surface; *and*

b. In less than 60 percent of the volume of all layers 15 cm or more thick."

NSTH 615.89, p. 615-478, following item JAIA.; Add new item JAIB. and renumber items JAIB. through JAIE. to JAIB. through JAIF.:

"JAIB. Other Epiaquepts that have fragic soil properties:

1. In 30 percent or more of the volume of a layer 15 cm or more thick that has its upper boundary within 100 cm of the mineral soil surface; *or*

2. In 60 percent or more of the volume of a layer 15 cm or more thick.

Fragic Epiaquepts"

NSTH 615.122, p. 615-646, column 1, following item 3. (definition of Typic Epiaquepts); Add item 4. as follows:

"4. Have fragic soil properties:

a. In less than 30 percent of the volume of all layers 15 cm or more thick that have the upper boundary within 100 cm of the mineral soil surface; *and*

b. In less than 60 percent of the volume of all layers 15 cm or more thick."

Page 243, column 2, line 10; Change item 5. to read:

"5. Do not have a fragipan with its upper boundary within 100 cm of the mineral soil surface;"

NSTH 615.62, p 615-298, following item JDGE. (Vitrandic Dystrochrepts, changed to JDHF.); Add new item JDHF. and renumber items JDHG. through JDHI. as JDHH. through JDHJ.:

"JDHF. Other Dystrochrepts that have *both*:

1. Fragic soil properties:

a. In 30 percent or more of the volume of a layer 15 cm or more thick that has its upper boundary within 100 cm of the mineral soil surface; *or*

b. In 60 percent or more of the volume of a layer 15 cm or more thick; *and*

2. In one or more horizons within 60 cm of the mineral soil surface, redox depletions with a chroma of 2 or less, and also aquic conditions in most years (or artificial drainage).

Fragiaquic Dystrochrepts"

NSTH 615.89, p 615-481, following item JDHI. (Oxyaquic Dystrochrepts changed to JDHJ. above); Add the following new item JDHK. and renumber items JDHK. through JDHP. as JDHL. through JDHQ.:

"JDHK. Other Dystrochrepts that have fragic soil properties:

1. In 30 percent or more of the volume of a layer 15 cm or more thick that has its upper boundary within 100 cm of the mineral soil surface; *or*

2. In 60 percent or more of the volume of a layer 15 cm or more thick.

Fragic Dystrochrepts"

NSTH 615.62, p. 615-299, column 2, following item 6. (definition of Typic Dystrochrepts); Add item 7. as follows:

"7. Have fragic soil properties:

a. In less than 30 percent of the volume of all layers 15 cm or more thick that have the upper boundary within 100 cm of the mineral soil surface; *and*

b. In less than 60 percent of the volume of all layers 15 cm or more thick."

NSTH 615.62, p 615-300, following item JDGF. (Anthraquic Eutrochrepts); Add the following new item JDGG. and renumber items JDGG. through JDGJ. as JDGH. through JDGK.:

"JDGG. Other Eutrochrepts that have *both*:

1. Fragic soil properties:

a. In 30 percent or more of the volume of a layer 15 cm or more thick that has its upper boundary within 100 cm of the mineral soil surface; *or*

b. In 60 percent or more of the volume of a layer 15 cm or more thick; *and*

2. In one or more horizons within 60 cm of the mineral soil surface, redox depletions with a chroma of 2 or less, and also aquic conditions in most years (or artificial drainage).

Fragiaquic Eutrochrepts"

NSTH 615.89, p 615-482, following item JDGJ. (Oxyaquic Eutrochrepts changed to JDHK. above); Add the following new item JDHL. and renumber items JDHL. through JDHS. as JDHM. through JDHT.:

"JDHL. Other Eutrochrepts that have fragic soil properties:

1. In 30 percent or more of the volume of a layer 15 cm or more thick that has its upper boundary within 100 cm of the mineral soil surface; *or*

2. In 60 percent or more of the volume of a layer 15 cm or more thick.

Fragic Eutrochrepts"

NSTH 615.89, p. 615-482, column 2, following item 4. (definition of Typic Eutrochrepts); Add item 5. as follows:

"5. Have fragic soil properties:

a. In less than 30 percent of the volume of all layers 15 cm or more thick that have the upper boundary within 100 cm of the mineral soil surface; *and*

b. In less than 60 percent of the volume of all layers 15 cm or more thick."

NSTH 615.62, p 615-304, following item JDEH. (Vitrandic Xerochrepts, changed to JDFI.); Add new item JDFJ. and renumber items JDFJ. through JDFM. as JDFK. through JDFO.:

"JDFJ. Other Xerochrepts that have *both*:

1. Fragic soil properties:

a. In 30 percent or more of the volume of a layer 15 cm or more thick that has its upper boundary within 100 cm of the mineral soil surface; *or*

b. In 60 percent or more of the volume of a layer 15 cm or more thick; *and*

2. In one or more horizons within 60 cm of the mineral soil surface, redox depletions with a chroma of 2 or less, and also aquic conditions in most years (or artificial drainage).

Fragiaquic Xerochrepts"

NSTH 615.89, p 615-482, before item JDEL. (Dystric Fluventic Xerochrepts changed to JDFN. above); Add new item JDFN. and renumber items JDFN. through JDFQ. as JDFO. through JDFS.:

"JDFN. Other Xerochrepts that have fragic soil properties:

1. In 30 percent or more of the volume of a layer 15 cm or more thick that has its upper boundary within 100 cm of the mineral soil surface; *or*

2. In 60 percent or more of the volume of a layer 15 cm or more thick.

Fragic Xerochrepts"

NSTH 615.62, p. 615-305, column 2, following item 10. (definition of Typic Xerochrepts); Add item 11. as follows:

"11. Have fragic soil properties:

a. In less than 30 percent of the volume of all layers 15 cm or more thick that have the upper boundary within 100 cm of the mineral soil surface; *and*

b. In less than 60 percent of the volume of all layers 15 cm or more thick."

NSTH 615.91, p. 615-578; Change item BAC. to read:

"BAC. Other Aquods that have a fragipan with its upper boundary within 100 cm of the mineral soil surface.

Fragiaquods"

NSTH 615.91, p. 615-580, column 2; Change item 4. to read:

"4. Do not have a fragipan with its upper boundary within 100 cm of the mineral soil surface;"

NSTH 615.91, p. 615-581, column 1; Change item 4. to read:

"4. Do not have a fragipan with its upper boundary within 100 cm of the mineral soil surface;"

NSTH 615.91, p. 615-581, column 2, line 5; Change item 4. to read:

"4. Do not have a fragipan with its upper boundary within 100 cm of the mineral soil surface;"

NSTH 615.91, p. 615-582, column 1; Change item 1. to read:

"1. Have a fragipan with its upper boundary within 100 cm of the mineral soil surface;"

NSTH 615.91, p. 615-582, column 2; Change item 4. to read:

"4. Do not have a fragipan with its upper boundary within 100 cm of the mineral soil surface;"

NSTH 615.91, p. 615-585; Change item BCC. to read:

"BCC. Other Humods that have a fragipan with its upper boundary within 100 cm of the mineral soil surface.

Fragihumods"

NSTH 615.91, p. 615-586, column 1, line 31; Change item 1. to read:

"1. Have a fragipan with its upper boundary within 100 cm of the mineral soil surface;"

NSTH 615.91, p. 615-586, column 2, line 3; Change item 1. to read:

"1. Do not have a fragipan with its upper boundary within 100 cm of the mineral soil surface;"

NSTH 615.91, p. 615-587; Change item BDC. to read:

"BDC. Other Orthods that have a fragipan with its upper boundary within 100 cm of the mineral soil surface.

Fragiorthods"

NSTH 615.91, p. 615-587, column 2; Change item 3. to read:

"3. Do not have a fragipan with its upper boundary within 100 cm of the mineral soil surface;"

NSTH 615.91, p. 615-588, column 2, line 54; Change item 1. to read:

"1. Have a fragipan with its upper boundary within 100 cm of the mineral soil surface;"

NSTH 615.91, p. 615-589, column 2, line 44; Change item 3. to read:

"3. Do not have a fragipan with its upper boundary within 100 cm of the mineral soil surface;"

NSTH 615.91, p 615-590, following item BDEB. (Lithic Haplorthods); Add new item BDEC. and renumber items BDEC. through BDEF. as BDED. through BDEG.:

"BDEC. Other Haplorthods that have *both*:

1. Fragic soil properties:

a. In 30 percent or more of the volume of a layer 15 cm or more thick that has its upper boundary within 100 cm of the mineral soil surface; *or*

b. In 60 percent or more of the volume of a layer 15 cm or more thick; *and*

2. In one or more horizons within 75 cm of the mineral soil surface, redoximorphic features, and also aquic conditions for some time in most years (or artificial drainage).

Fragiaquic Haplorthods"

NSTH 615.91, p 615-590, following item BDEF. (Oxyaquic Haplorthods changed to BDEG. above); Add new item BDEH. and renumber items BDEG. through BDEK. as BDEI. through BDEN.:

"BDEH. Other Haplorthods that have fragic soil properties:

1. In 30 percent or more of the volume of a layer 15 cm or more thick that has its upper boundary within 100 cm of the mineral soil surface; *or*

2. In 60 percent or more of the volume of a layer 15 cm or more thick.

Fragic Haplorthods"

NSTH 615.91, p. 615-590, column 2, following item 6. (definition of Typic Haplorthods); Add item 7. as follows:

"7. Have fragic soil properties:

a. In less than 30 percent of the volume of all layers 15 cm or more thick that have the upper boundary within 100 cm of the mineral soil surface; *and*

b. In less than 60 percent of the volume of all layers 15 cm or more thick."

NSTH 615.89, p. 615-508; Following item GAHA. add the new items GAHB. and GAHC. and renumber items GAHB. through GAHE. as GAHD. through GAHG.:

"GAHB. Other Epiaquults that have:

1. Fragic soil properties;

a. In 30 percent or more of the volume of a layer 15 cm or more thick that has its upper boundary within 100 cm of the mineral soil surface; *or*

b. In 60 percent or more of the volume of a layer 15 cm or more thick; *and*

2. Have, 50 percent or more chroma of 3 or more in one or more horizons between either the A or Ap horizon or a depth of 25 cm from the mineral soil surface, whichever is deeper, and a depth of 75 cm;

Aeric Fragic Epiaquults

IAIG. Other Epiaqults that have fragic soil properties;

1. In 30 percent or more of the volume of a layer 15 cm or more thick that has its upper boundary within 100 cm of the mineral soil surface; *or*

2. In 60 percent or more of the volume of a layer 15 cm or more thick; and

Fragic Episaquults"

NSTH 615.89, p. 615-508; Following item 3. of the definition of Typic Epiaquults add item 4. as follows:

"4. Have fragic soil properties:

a. In less than 30 percent of the volume of all layers 15 cm or more thick that have the upper boundary within 100 cm of the mineral soil surface; *and*

b. In less than 60 percent of the volume of all layers 15 cm or more thick."

Page 351; Change item FAB. (changed to GAB.) to read:

"GAB. Other Aquults that have a fragipan with its upper boundary within 100 cm of the mineral soil surface.

Fragiaquults"

Page 351, column 2, line 56; After the word "fragipan" add:

" with its upper boundary within 100 cm of the mineral soil surface"

Page 352, column 1, line 18; After the word "fragipan" add:

" with its upper boundary within 100 cm of the mineral soil surface"

NSTH 615.38 p. 615-78; Change item 5. to read:

"5. Do not have a fragipan with its upper boundary within 100 cm of the mineral soil surface;"

NSTH 615.38 p. 615-79; Change item 4. to read:

"4. Do not have a fragipan with its upper boundary within 100 cm of the mineral soil surface;"

Page 353, column 1, line 9, item 1. (rev in NSTH 615.38 p. 615-80); Change item 1. to read as follows, add new item 2., and renumber items 2. through 5. as 3. through 6.:

"1. Do not have a kandic horizon;

2. Do not have a fragipan with its upper boundary within 100 cm of the mineral soil surface;"

Page 353, column 2, line 38, item 1. (rev in NSTH 615.38 p. 615-80); Change item 1. to read as follows, add new item 2., and renumber items 2. and 3. as 3. and 4.:

"1. Do not have a kandic horizon;

2. Do not have a fragipan with its upper boundary within 100 cm of the mineral soil surface;"

Page 355, column 2, line 14; Revise item 2. as follows:

"2. Do not have a fragipan with its upper boundary within 100 cm of the mineral soil surface;"

Page 360 and NSTH 615.38 p. 615-85; Change item FCA. (changed to GCB.) to read:

"GCB. Other Udults that have a fragipan with its upper boundary within 100 cm of the mineral soil surface.

Fragiudults"

NSTH 615.38 p. 615-87; Rewrite item 5. as follows:

"5. Do not have a fragipan with its upper boundary within 100 cm of the mineral soil surface."

NSTH 615.38 p. 615-89; Rewrite item 4. as follows:

"4. Do not have a fragipan with its upper boundary within 100 cm of the mineral soil surface."

Page 360, column 2; Rewrite the first sentence of the description of Fragiudults to read:

"These are Udults that have a fragipan with its upper boundary within 100 cm of the mineral soil surface."

Page 361, column 1; Rewrite item a.(1) of the description of Typic Fragiudults to read:

"(1) Have a fragipan with its upper boundary within 100 cm of the mineral soil surface; and"

Page 362, column 2, line 25; Revise item 1. and add new item 2. as follows and renumber items 2. through 5 as 3. through 6.:

"1. Do not have a Kandic horizon;

2. Do not have a fragipan with its upper boundary within 100 cm of the mineral soil surface;"

NSTH 615.62, p 615-372, following item GCGC. (Vertic Hapludults); Add new item GCGD. and renumber items GCGD. through GCGG. (Aquic Hapludults, renumbered above) as GCGE. through GCGF.:

"GCGD. Other Hapludults that have *both*:

1. Fragic soil properties:

a. In 30 percent or more of the volume of a layer 15 cm or more thick that has its upper boundary within 100 cm of the mineral soil surface; *or*

b. In 60 percent or more of the volume of a layer 15 cm or more thick; *and*

2. In one or more layers within 75 cm of the mineral soil surface, redox *depletions* with a color value, moist, of 4 or more and a chroma of 2 or less, accompanied by redox concentrations, and also aquic conditions for some time in most years (or artificial drainage).

Fragiaquic Hapludults"

NSTH 615.62, p 615-375, following item GCDK. (Aquic Hapludults, renumbered above as GCGF.); add new item GCGG. and renumber items GCGG. through GCGM., to GCGH. to GCGO.:

"GCGG. Other Hapludults that have fragic soil properties:

1. In 30 percent or more of the volume of a layer 15 cm or more thick that has its upper boundary within 100 cm of the mineral soil surface; *or*

2. In 60 percent or more of the volume of a layer 15 cm or more thick.

Fragic Hapludults"

NSTH 615.62, p. 615-373, column 1; Following item 8. (definition of Typic Hapludults); Add item 9. as follows:

"9. Have fragic soil properties:

a. In less than 30 percent of the volume of all layers 15 cm or more thick that have the upper boundary within 100 cm of the mineral soil surface; *and*

b. In less than 60 percent of the volume of all layers 15 cm or more thick."

NSTH 615.62, p 615-375, following item GCDA. (Lithic Kanhapludults); Add new item GCDB. and renumber items GCDB. through GCDG. (Aquic Kanhapludults) as GCDC. through GCDH.:

"GCDB. Other Kanhapludults that have *both*:

1. Fragic soil properties:

a. In 30 percent or more of the volume of a layer 15 cm or more thick that has its upper boundary within 100 cm of the mineral soil surface; *or*

b. In 60 percent or more of the volume of a layer 15 cm or more thick; *and*

2. In one or more layers within 75 cm of the mineral soil surface, redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, accompanied by redox concentrations, and also aquic conditions for some time in most years (or artificial drainage).

Fragiaquic Kanhapludults"

NSTH 615.62, p 615-375, before item GCDK. (Rhodic Kanhapludults); Add new item GCDK. and renumber items GCDH. (Plinthic) as GCDL., GCDK as GCDM., GCDL. as GCDN.:

"GCDK. Other Kanhapludults that have fragic soil properties:

1. In 30 percent or more of the volume of a layer 15 cm or more thick that has its upper boundary within 100 cm of the mineral soil surface; *or*

2. In 60 percent or more of the volume of a layer 15 cm or more thick.

Fragic Kanhapludults"

NSTH 615.62, p. 615-376, column 2, following item 8. (definition of Typic Kanhapludults); Add item 9. as follows:

"9. Have fragic soil properties:

a. In less than 30 percent of the volume of all layers 15 cm or more thick that have the upper boundary within 100 cm of the mineral soil surface; *and*

b. In less than 60 percent of the volume of all layers 15 cm or more thick."

NSTH 615.90, p 615-548, following item GCEA. (Vertic Paleudults); Add new item GCEB. and renumber items GCEB. through GCEE. as GCDC. through GCDH., Delete item GCEK. (Plinthaquic Paleudults renumbered as GCEF. above):

"GCDB. Other Paleudults that have *both*:

1. Fragic soil properties:

a. In 30 percent or more of the volume of a layer 15 cm or more thick that has its upper boundary within 100 cm of the mineral soil surface; *or*

b. In 60 percent or more of the volume of a layer 15 cm or more thick; *and*

2. In one or more layers within 75 cm of the mineral soil surface, redox depletions with a color value, moist, of 4 or more and a chroma of 2 or less, accompanied by redox concentrations, and also aquic conditions for some time in most years (or artificial drainage).

Fragiaquic Paleudults"

NSTH 615.62, p 615-378, item GCEO. (Fragic Paleudults renumbered as GCEQ.); Revise and renumber as follows, and renumber items GCEJ to GCEN. (Plinthic Paleudults renumbered as GCEP.), as GCEK. to GCES.:

"GCEJ. Other Paleudults that have fragic soil properties:

1. In 30 percent or more of the volume of a layer 15 cm or more thick that has its upper boundary within 100 cm of the mineral soil surface; *or*

2. In 60 percent or more of the volume of a layer 15 cm or more thick.

Fragic Paleudults"

NSTH 615.62, p. 615-379, column 1; (definition of Typic Paleudults); Revise item 7. as follows:

"7. Have fragic soil properties:

a. In less than 30 percent of the volume of all layers 15 cm or more thick that have the upper boundary within 100 cm of the mineral soil surface; *and*

b. In less than 60 percent of the volume of all layers 15 cm or more thick."

Page 364, column 1 and NSTH 615.38 p. 615-91; Revise item 2. and add new item 3. as follows and renumber item 3. as 4.:

"1. Do not have a Kandic horizon;

2. Do not have a fragipan with its upper boundary within 100 cm of the mineral soil surface;"

Page 367, column 1 and NSTH 615.38 p. 615-91; Revise item 3. and add new item 4. as follows and renumber items 4. and 5. as 5. and 6.:

"3. Do not have a kandic horizon;

4. Do not have a fragipan with its upper boundary within 100 cm of the mineral soil surface;"

615.161 Udic subgroups of Borolls

NSTH 615.62, p. 615-317, Revise items HEDC.2. (Glossic Udic Argiborolls, changed to HEDM.2. above) as follows:

"2. A udic moisture regime."

NSTH 615.62, p. 615-318, Revise items HEDJ.2. (Pachic Udic Argiborolls, changed to HEDO.2. above) as follows:

"2. A udic moisture regime."

NSTH 615.62, p. 615-319, Revise items HEDP. (Udic Argiborolls, changed to HEDV. above) as follows:

"HEDV. Other Argiborolls that have a udic moisture regime."

NSTH 615.62, p. 615-319, Delete part 6.b. of items 6. (Definition of Typic Argiborolls) and add an item 9. as follows:

"9. Do not have a udic moisture regime."

NSTH 615.62, p. 615-323, Revise items HEGD.1. (Udertic Haploborolls, changed to HEGI.1. above) as follows:

"1. A udic moisture regime; *and*"

NSTH 615.62, p. 615-323, Revise items HEGH.4. (Cumulic Udic Haploborolls, changed to HEGN.4. above) as follows:

"4. A udic moisture regime."

NSTH 615.62, p. 615-323, Revise items HEGJ.2. (Pachic Udic Haploborolls, changed to HEGN.2. above) as follows:

"2. A udic moisture regime."

NSTH 615.62, p. 615-324, Revise items HEGR.1. (Udorthentic Haploborolls, changed to HEGY.1. above) as follows:

"1. A udic moisture regime; *and*"

NSTH 615.62, p. 615-324, Revise items HEGS. (Udic Haploborolls, changed to HEGZ. above) as follows:

"HEGZ. Other Haploborolls that have a udic moisture regime."

NSTH 615.62, p. 615-325, Delete part 3.b. of items 6. (Definition of Typic Haploborolls) and add an item 10. as follows:

"10. Do not have a udic moisture regime."

NSTH 615.62, p. 615-325, Revise items HECC.2. (Glossic Udic Natriborolls, changed to HECG.2. above) as follows:

"2. A udic moisture regime."

NSTH 615.62, p. 615-325, Revise items HECE. (Udic Natriborolls, changed to HECH. above) as follows:

"HECH. Other Natriborolls that have a udic moisture regime."

NSTH 615.62, p. 615-326, Delete part 2.b. of items 6. (Definition of Typic Natriborolls) and add an item 4. as follows:

"4. Do not have a udic moisture regime."

NSTH 615.62, p. 615-327, Revise items HEED. (Udic Vermiborolls) as follows:

"HEED. Other Vermiborolls that have a udic moisture regime."

NSTH 615.62, p. 615-327, Delete part 2.b. of items 6. (Definition of Typic Vermiborolls) and add an item 4. as follows:

"4. Do not have a udic moisture regime."

615 162 Corrections and Clarifications

Editorial changes and corrections of typographical and grammatical errors are made throughout the text to clarify the intent of the criteria.

NSTH 615.127, p. 615-652,

Page 28, Natric horizon item 1.b.; Revise as follows:

"b. Both, blocky structure and eluvial materials, which contain uncoated silt or sand grains, and extend more than 2.5 cm into the horizon; and"

Page 48, NSTH 615.89, p. 615-424, aquic conditions, foomote 2 on "artificial drainage"; Add after "from soils" the following ", having aquic conditions,"

Page 125 item HEC.1.; Rewrite as follows:

"1. A discontinuous albic horizon or no albic horizon above the argillic horizon; *and*"

Page 309, column 1, line 38; Change "Calcidic" to "Calciargidic".

NSTH 615.26, p. 615-30, line 12.; Change "Aridic" to "Argiduridic". (Was changed in 1994 Keys)

Page 54 column 1, line 24; Delete last 7 lines starting at "The moisture regime" and insert the following:

"Such soils are considered to have a *peraquic* moisture regime.

The distinction between the *aquic* moisture regime and the *peraquic* moisture regime is not closely defined because neither regime is used as a criterion for taxa. These terms, however, can be used in descriptions of taxa.

Some soils with an aquic moisture regime also have a xeric ustic or aridic (torric) moisture regime."

NSTH 615.115, p. 615-624, item FGDA.; Delete word "Other".

NSTH 615.62, p. 615-336, Item HFAE.; Revise as follows:

"HFAE. Other Durustolls which have a duripan that is neither very strongly cemented nor indurated in any subhorizon.
Haplic Durustolls"

NSTH 615.115, p. 615-625, item FGDK.; Revise as follows:

"FGDK. Other Haplocambids that have both:

1. A horizon at least 25 cm thick within 100 cm of the soil surface, which has an exchangeable sodium percentage of 15 or more (or an SAR of 13 or more) during at least one month of the year in six or more years out of ten; *and*