United States Department of Agriculture
Soil Conservation Service
P.O. Box 2890
Washington, D.C.
20013

April 18, 1994

NATIONAL SOIL TAXONOMY HANDBOOK
430-VI
ISSUE NO. 17

SUBJECT: SOI - REVISED NATIONAL SOIL TAXONOMY HANDBOOK

Purpose: To distribute amended pages to the Soil Taxonomy which is now filed within the National Soil Survey Handbook.

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

Filing instructions: National Soil Taxonomy Handbook Issues Nos. 1 through 16 are now apart of the National Soil Survey Handbook Part 615. This issue should be filed as follows:

File page iii "Contents" following page ii. Replace pages vii and viii of "Index to pages of Soil Taxonomy" dated August 1992 with the attached pages vii through x of the index dated April 1994. File pages 615-605 to 615-662 following pages 615-604.

Supplementation: States and NTC's may not supplement the handbook.

ROBERT R. SHAW
Deputy Chief for Technology

Attachments

Part 615 - Amendments to Soil Taxonomy

Section

Index to pages of Soil Taxonomy

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)
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), (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 p. 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, 358, 366, 371, 373,
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)

615.112 Strongly contrasting particle-size classes

NSTH 615.60, p. 615-207, Strongly contrasting particle-size classes (*Soil Taxonomy* p. 385). Renumber items 1-6 as 2-7 and 7-53 as 9-55, and add new items 1 and 8 to read as follows:

"1. Ashy over clayey.

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."

NSTH 615.60, page 207, Strongly contrasting particle-size classes (*Soil Taxonomy* p. 385). Change new items 17 (put in alphabetical order and correct numbering), 25, 38, and 39 to read as follows:

"17. Clayey-skeletal over sandy or sandy-skeletal.

25. Loamy over pumiceous or cindery.

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."

615.113 Sloping families

Slope, or shape of slope, has been used as a family differentia for soils of certain aquic great groups. The differentia is not clearly defined, and as a result has been ignored or used inconsistently. The original intent in recognizing sloping families was to identify differences in the difficulty of removing excess water. Thirteen series in the United States are classified in sloping families. The slope range for these series often overlaps with similar series which are classified the same above the family level, but are not in a sloping family. A cursory check of soil series in aquic great groups reveals that there are series in the data base that should be in a sloping family, but are not. This inconsistent use of the sloping-family criterion has resulted in meaningless separations, and the criterion is therefore deleted.

Page 383, Family differentiae for mineral soils. Delete "Soil slope classes" from list.

Page 388, Other characteristics. In last line, delete "slope of soil, ".

Page 389, Slope or shape of soil. Delete whole section on "Slope or shape of soil".

615.114 Corrections and clarification

Editorial changes have been made throughout the keys in *Soil Taxonomy* and throughout the text extracted for use in *Keys to Soil Taxonomy* to make grammatical corrections and clarify the intent of the criteria.

615.115 Aridisol amendment[1]

Introduction

Page 41, left column. Delete the section entitled "Duripan" and replace with the following:

Duripan

The duripan (L. *durus*, hard; meaning hardpan) is a subsurface horizon that is cemented by illuvial silica to the degree that less than 50 percent of the volume of air-dry fragments slake in water or during prolonged soaking in acid (HCl). Duripans vary in the degree of cementation by silica and, in addition, they commonly contain accessory cements, chiefly iron oxides and calcium carbonate. As a consequence, duripans vary in appearance, most of them are very firm or firmer and they are always brittle, even after prolonged wetting. They grade into and can occur in conjunction with the petrocalcic horizons mostly in semiarid and arid climates. They also grade into noncemented earthy materials and into the fragipans of humid climates.

Genesis

Duripans occur mostly in soils with a xeric or aridic moisture regime (defined later), that is, in soils that are seasonally dry or are usually dry. Most soils that have a duripan have a moisture regime in which soluble silica might be expected to be translocated into lower horizons, but not out of the soil.

Geographically, duripans are largely in areas of volcanism. Soils may show evidence of recent ash deposition, or they may be forming in sediments derived from pyroclastic materials such as tuffs and ignimbrites. The most strongly expressed cementation is commonly in soils that contain an appreciable amount of volcanic glass in the overlying horizons, which suggests the importance of soluble silica to the genesis. Glass tends to weather rapidly and the weathering can liberate soluble silicates at a rapid rate. If glass is absent in the overlying horizons, there commonly is reason to suspect that it was once in the soil.

Weathering of ferromanganesium minerals and feldspars may also contribute toward duripan formation.

The parent materials of many soils that have a duripan contain only a small amount of calcium. If calcium is abundant, a calcic horizon tends to supplant or occur with the duripan.

Once formed, a duripan may become broken into blocky fragments, perhaps by earthquakes or slight volume changes from wetting and drying. To be considered a duripan, the lateral spacing of cracks, that are wide enough to allow the entry of feeder roots, must average 10 cm or more.

Appearance in an arid climate

The strongly cemented to indurated duripans of arid climates (aridic moisture regime defined later) have an abrupt upper boundary and are commonly platy, with the plates roughly 1 to 15 cm thick. In many of these pans, the pores and the surfaces of the plates are coated with opal and with some birefringent material that is probably a microcrystalline form of silica. Carbonates generally are present in small to large amounts. Roots commonly are between the plates. More than 50 percent of the cementation can be destroyed by alternately soaking in acid and concentrated alkali. The acid is used to destroy any cementation by carbonates. If some of the cements are carbonates or if a petrocalcic horizon is present, less than 50 percent of the cementation is destroyed by soaking in acid, but more than 50 percent is destroyed by soaking in concentrated alkali, either as a single treatment or by alternating treatments with acid. The presence of a thin continuous layer of opal, that is insoluble in acid, indicates enough cementation by silica to satisfy the requirements of a duripan. A duripan and petrocalcic horizon can occur in conjunction with each other. If a horizon is cemented and satisfies the criteria of the petrocalcic horizon, any continuous horizon within the cemented layers that does not slake, in 50 percent or more of the volume, in acid is also considered a duripan. Commonly a nearly continuous layer of secondary silica occurs in the part of the horizon that does not slake in acid.

The forms of a duripan that are transitional to regolith in arid climates are mostly massive and firm or very firm when moist and are brittle at all moisture states. Laminar caps of silica and coatings of silica on plates are uncommon. For a horizon to be a duripan more than 50 percent of the horizon must not slake in water nor in HCl and it must have at least (1) a few vertical opal coatings, (2) some opal or other forms of silica partly filling interstices or forming bridges between sand-size mineral grains, or (3) some silica coatings or pendants on the under sides of rock fragments. Moistened specimens of these forms of the duripan commonly show a dull glassy luster when viewed under a hand lens. The most weakly cemented forms of these transitional duripans can be penetrated with some difficulty with a hand powered soil auger. Under irrigation such horizons commonly are slowly permeable to water, and, except in cracks, they are virtually impenetrable to roots of most plants.

Appearance in a Mediterranean climate

In Mediterranean climates, (xeric moisture regime defined later), commonly the pan has an abrupt upper boundary, and is broken into very coarse prisms, or into polyhedrons that are roughly 30 cm to 3 m or more in diameter. Coatings of opal partly line the faces of the prisms and many of the pores. The coatings are shown in plate 5C. Roots are absent in the prisms except in cracks, and are commonly matted on the upper boundary of the pan and on sides of the prisms. The prisms may have been formed by the slight volume changes that result from wetting and drying. This process of formation is suggested by the absence of prisms in the duripans of arid regions.

The more strongly cemented pans of Mediterranean climates have opal coatings over the tops of the polyhedrons as well as on the sides, and the coatings are thicker than in the more weakly cemented pans. Water often perches on top of the pan during the rainy season. Coatings of iron, manganese, and oriented clay may be observed on many of these pans. Subsequent deposits of opal could engulf such coatings and give rise to a cementation that can be broken down only by repeated alternating treatments with solutions of acid and concentrated alkali. Carbonates may be present above the pan or in any part of it, or they may be completely absent. These observations indicate that carbonates are not an essential part of the pans.

The most weakly cemented forms of the duripans in a Mediterranean climate are mostly transitional to regolith. Brittleness in these pans is pronounced at all moisture states, but most can be penetrated with some difficulty by a hand powered soil auger. When dry, most of these pans are very hard and have slow permeability.

In more humid climates, (udic moisture regime defined later) many of the duripans are in soils that have andic soil properties (defined later) in some overlying horizons. Some have characteristics transitional to the fragipan, which is discussed later. Some of these pans have redoximorphic features of gray and strong brown. Secondary carbonates and salts are absent in these pans. The strength of cementation in the pan must be strong enough that less than 50 percent of dry pan fragments slake when placed in water. Some meet the

[1] This chapter on Aridisols was rewritten in 1994 following the recommendations of the International Committee on Aridisols (ICOMID), chaired by Dr. A. Osman. Major contributions were made by Dr. H. Eswaran and J. Nichols.

requirements of a fragipan if more than 50 percent of dry pan fragments slake when placed in water.

Summary of properties

The duripan is a silica-cemented subsurface horizon with or without auxiliary cementing agents. A duripan can occur in conjunction with a petrocalcic horizon.

A duripan must meet all of the following requirements:

1. Is cemented or indurated in more than 50 percent of the volume of some horizon; and

2. Has evidence of accumulation of opal or other forms of silica as laminar capping, coatings, lenses, partly filled interstices, bridges between sand-size grains, or coatings on rock fragments; and

3. Less than 50 percent of the volume slakes in 1N HCl even during prolonged soaking, but more than 50 percent slakes in concentrated KOH, NaOH, or in alternating acid and alkali; and

4. Has lateral continuity such that roots cannot penetrate except along vertical fractures, which have a horizontal spacing of 10 cm or more."

Page 45, left column. Delete the section entitled "Calcic horizon and ca horizon" and replace with the following:

"Calcic horizon

The calcic horizon is an illuvial horizon in which secondary calcium carbonate, or other carbonates have accumulated to a significant extent. It may occur in conjunction with various other horizons such as a mollic epipedon, an argillic or a natric horizon.

Commonly, a calcic horizon has developed in unconsolidated materials of more or less mixed mineralogical composition. 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. In such situations, the horizon is considered a calcic horizon if the carbonate content ($CaCO_3$ equivalent) of a layer 15 cm or more thick exceeds 15 percent by weight (5 percent if the soil is less than 18 percent clay and has a sandy, sandy-skeletal, coarse-loamy, or loamy-skeletal particle size class) and the layer has at least 5 percent more $CaCO_3$ equivalent than an underlying layer.

Limestones and marls are formed by precipitation of calcium carbonate or of calcium and magnesium carbonates in water and may appear similar to calcic horizons. A calcic horizon formed on limestone or in marl may be difficult to identify. The most useful diagnostic feature for recognition of the calcic horizon in such situations is the presence of a layer that contains powdery calcium carbonate, concretions, or laminar pendants on the lower sides of limestone fragments. If the percentage, by volume, of redeposited (authigenic) calcium carbonate exceeds 5 percent in a layer 15 cm or more thick, the horizon should be considered a calcic horizon.

Some parts of a calcic horizon may be cemented or indurated, though typically air-dry fragments of a calcic horizon will slake in water, except for disconnected carbonate concretions and pendants under rock fragments. If a horizon with secondary carbonates is indurated or cemented to such a degree that it meets the requirements of a petrocalcic horizon, it is considered a petrocalcic horizon (defined below). Plate 6C shows a soil that has a calcic horizon between a depth of about 20 and 100 cm.

The genetic implications of a calcic horizon are variable. In arid regions, if the parent materials contain considerable amounts of calcium, the very limited rainfall seems insufficient to completely remove calcium carbonate from even the surface few centimeters. About the only significant horizon that can develop in such a soil is a calcic horizon. Pedon 36 illustrates such a situation. In this soil the calcic horizon extends from a depth of 10 to 58 cm.

In some soils in semiarid regions, a mollic epipedon may develop in addition to a calcic horizon. Apparently, no other horizons ordinarily develop. Pedon 37 illustrates such a soil. The mollic epipedon is 38 cm thick, and it rests on a calcic horizon that extends to a depth of 145 cm.

Some soils in semiarid regions have a calcic horizon above and in an argillic horizon. It is presumed that the argillic horizon developed under a climate wetter than the present one. These soils are receiving carbonates from eolian sources, and a calcic horizon is now forming at a relatively shallow depth. In such situations, the calcic horizon is presumed to start where the identifiable secondary carbonates amount to 5 percent or more by volume, and the $CaCO_3$ equivalent exceeds 15 percent if the soil is more than 18 percent clay.

In soils that have, near the surface, ground water that contains an appreciable amount of calcium bicarbonate, the capillary rise and the evaporation plus transpiration cause precipitation of a large amount of calcium carbonate. Depending on the depth from the surface to the capillary fringe, the top of the zone of calcium carbonate accumulation may be from the surface to a depth of about 60 cm. In such soils, the accumulation of calcium carbonate is comparable to the accumulation of more soluble salts in desert playas. Pedon 38 is a soil that has such a calcic horizon in the upper 46 cm of the soil. The calcic horizon in this soil is also a mollic epipedon. Depending on the position of the water table, such soils may occupy depressions. If water was ponded, a soil that has a calcic horizon commonly forms a circular outline around the deeper depressions and can also occur on micro high elevations in the depressions.

In the situations just discussed, one might attach a high genetic significance to a calcic horizon. In some other circumstances, however, one can attach little genetic significance to the absolute amount of carbonates in a horizon or layer of carbonate accumulation. Deposition from ground water at a depth of 3 m or more is more nearly a geologic than a pedologic process. In soils formed from calcareous materials on the steppes, the amount of calcium carbonate in horizons that contain secondary calcium carbonate is a partial function of the amount of calcium carbonate in the parent materials.

Pedon 5 is typical of a soil in which there is a calcic horizon of little genetic significance. The mollic epipedon and the natric horizon are significant to the classification of this soil. The presence of a horizon that has secondary carbonates is significant, but the absolute amount of calcium carbonate in that horizon depends on both the amount of secondary carbonates and the amount of carbonates in the parent material.

The calcic horizon has all of the following properties:

1. Is 15 cm or more thick; and:

2. Is not indurated or cemented to such a degree that it meets the requirements of a petrocalcic horizon; and

3. Has one or more of the following:

a. Fifteen percent or more $CaCO_3$ equivalent, (see below) and its $CaCO_3$ equivalent is 5 percent or more (absolute) higher than that of an underlying horizon; or

b. Fifteen percent or more $CaCO_3$ equivalent, and 5 percent or more (by volume) identifiable secondary carbonates; or

c. Five percent or more calcium carbonate equivalent and has:

(1). Less than 18 percent clay in the fine-earth fraction; and

(2). A particle size that is sandy, sandy-skeletal, coarse-loamy, or loamy-skeletal; and

(3). A weight of identifiable secondary carbonates, that is 5 percent or more (absolute) higher than that of an underlying horizon."

Page 46, Left column. Delete section under "Gypsic horizon"and replace with the following:

"Gypsic horizon

The gypsic horizon is an illuvial horizon in which secondary gypsum has accumulated to a significant extent.

A gypsic horizon has all of the following properties:

1. Is 15 cm or more thick; and

2. Is not cemented or indurated to such a degree that it meets the requirements of a petrogypsic horizon; and

3. Is 5 percent or more gypsum and is 1 percent or more by volume secondary visible gypsum; and

4. Has a product of thickness in centimeters multiplied by gypsum content percentage of 150 or more.

Thus, a horizon 30 cm thick that is 5 percent gypsum qualifies as a gypsic horizon if it is 1 percent or more by volume visible gypsum and is not cemented or indurated to such a degree that it meets the requirements of a petrogypsic horizon.

The gypsum percentage can be calculated by multiplying the milliequivalents of gypsum per 100 g soil by the milliequivalent weight of $CaSO_4\ 2H_2O$, which is 0.086.

Gypsum may accumulate uniformly throughout a matrix of sand and finer textured material or as nests of crystals. In gravely or stony material it may accumulate in pendants below the pebbles or stones.

Pedon 39 illustrates a gypsic horizon. In this soil there is a calcic horizon between a depth of 13 cm and 56 cm and a gypsic horizon between a depth of 56 cm and 180 cm."

Page 46, left column. Delete section under "Petrocalcic horizon" and replace with the following:

"Petrocalcic horizon

The petrocalcic horizon is an illuvial horizon in which secondary calcium carbonate or other carbonates have accumulated to the extent that the horizon is cemented or indurated.

In some soils forming in parent materials that are rich in carbonates or that receive regular additions of carbonates in dust, the calcic horizon tends in time to become plugged with carbonates and cemented into a massive, continuous horizon. There is also evidence that a petrocalcic horizon can form through a process of limestone alteration by in situ dissolution and precipitation of carbonates. Petrocalcic horizons are mainly in soils older than the Holocene and seem to be a mark of advanced soil evolution.

The petrocalcic horizon is indurated or cemented throughout each pedon by calcium carbonate or, less commonly, by calcium and magnesium carbonate, with or without accessory silica, to such a degree that dry fragments do not slake in water and roots cannot enter except in cracks that have a horizontal spacing of 10 cm or more. If soaked in acid, cementation of the petrocalcic horizon is destroyed in half or more of its lateral extent in each pedon. The horizon is commonly massive or platy, very hard or harder and very firm or firmer when moist. Its saturated hydraulic conductivity is commonly moderately low to very low unless the horizon is fractured.

A laminar cap may be present but is not required. If one is present, carbonates normally constitute half or more by weight of the laminar horizon. Gravel, sand, and silt grains have been separated by the crystallization of carbonates in at least parts of the laminar subhorizon. Figure 3 shows a slice through the upper 13 cm of a petrocalcic horizon. Sand and gravel have been largely pushed aside by crystallization of calcium carbonate at the surface of the laminar horizon. Radiocarbon dates of the organic and inorganic carbon indicate that this laminar horizon is late Wisconsinan to Holocene in age and that the cementation of the underlying gravel took place during the late Pleistocene.

Pedon 40 illustrates a soil that has a petrocalcic horizon. The petrocalcic horizon lies between a depth of 28 cm and 64 cm. Plate 10D shows a soil with a petrocalcic horizon that has its upper boundary at a depth of about 70 cm and its lower boundary at a depth of about 150 cm.

A petrocalcic horizon must meet the following requirements:

1. It is cemented or indurated by carbonates with or without silica or other cementing agents; and

2. Has a lateral continuity such that roots cannot penetrate except along vertical fractures, which have a horizontal spacing of 10 cm or more; and

3. Has a thickness of:

a. 10 cm or more; or

b. 1 cm or more if it consists of a laminar capping directly underlain by bedrock."

Page 47, left column. Delete section under "Petrogypsic horizon" and replace with the following:

"Petrogypsic horizon

The petrogypsic horizon is an illuvial horizon 10 cm or more thick in which secondary gypsum has accumulated to the extent that the horizon is cemented or indurated. Dry fragments do not slake in water and roots cannot enter except in vertical fractures which have a horizontal spacing of 10 cm or more. Its minimum gypsum content is 5 percent and the product of the thickness in centimeters multiplied by the gypsum content percentage is 150 or more. Commonly the gypsum content is far greater than the minimum requirements, in many pedons it is 60 percent or more. Petrogypsic horizons are only known to occur in arid climates and to parent materials that are rich in gypsum. They are rare in the United States but are common in parts of Africa and Asia.

A petrogypsic horizon must meet the following requirements:

1. It is cemented or indurated by gypsum with or without other cementing agents; and

2. Has a lateral continuity such that roots cannot penetrate except along vertical fractures, which have a horizontal spacing of 10 cm or more; and

3. Has a thickness of 10 cm or more; and

4. Is 5 percent or more gypsum and the product of the thickness in centimeters multiplied by the gypsum content percentage is 150 or more."

Page 47, left column. Delete section under "Salic horizon"and replace with the following:

"Salic Horizon

A salic horizon is a horizon of accumulation of salts which are more soluble than gypsum in cold water.

Much of the salt is commonly halite, the crystalline form of sodium chloride. In some areas, soluble sulfates may also accumulate with the crystalline forms such as thernadite, hexahydrite, epsomite, and mirabilite. Some of the commonly occurring bicarbonates are trona and natron. Under extreme aridic conditions and at low temperatures, evaporites of calcium chloride, nitrates, and other soluble salts may accumulate. Identification of the kinds of crystalline salts requires detailed mineralogical analyses.

A salic horizon is 15 cm or more thick and has for 90 consecutive days or more per year, in 6 or more years out of 10:

1. An electrical conductivity (EC) equal to or greater than 30 ds/m in a 1:1 soil : water extract; and

2. The product of the EC in ds/m and thickness in cm equal 900 or more."

Page 51, right column. Delete section under "Soft powdery lime" and replace with the following:

"Identifiable Secondary Carbonates

Identifiable secondary carbonates is a term used in the definitions of a number of taxa. It refers to translocated authigenic calcium carbonate that has been precipitated in place from the soil solution rather than inherited from a soil parent material such as a calcareous loess or till.

Identifiable secondary carbonates may either disrupt the soil structure or fabric to form masses, nodules, concretions, or spheroidal aggregates (white eyes) that are soft and powdery when dry; or it may be present as coatings in pores, on structural faces, or on the undersides of rock fragments. If present as coatings, it covers a significant part of the surfaces. Commonly, it coats all of them to a thickness of 1 mm or more; but if little calcium carbonate is present in the soil, the surfaces may be only partially coated. The coatings must be thick enough to be visible when moist. In some horizons with much calcium carbonate the entire horizon is colored by secondary carbonates.

The filaments (pseudomycelia) commonly seen in a dry calcareous horizon are within the meaning of identifiable secondary carbonates, if the filaments are thick enough to be visible when the soil is moist. Filaments commonly branch on structural faces."

Page 85, left column, line 53. Change "Typic Durargid" to"Typic Argidurid".

Page 85, left column, line 54. After indurated, add "orvery strongly cemented,"

Page 85, right column. Replace lines 1-6 with "aberrant feature of an Argidic Argidurid is that the duripan is strongly cemented or less cemented throughout, it is considered to intergrade toward the Argids. The name, however, is Argidic Argidurids, not Haplargidic Argidurids."

Page 88, right column, lines 19 and 20. Change "Lithic Ruptic-Entic Xerollic" to "Lithic Ruptic-Entic"

Page 95, Key to soil orders, Aridisols (refer to NSTH page 615-179). Change item F to read as follows:

"F. Other soils that:

1. Have:

a. An aridic soil moisture regime; and

b. An ochric or anthropic epipedon; and

c. One or more of the following with the upper boundary within 100 cm of the soil surface: an argillic, calcic, cambic, gypsic, natric, petrocalcic, petrogypsic, or a salic horizon, or a duripan; or

2. Have

a. A salic horizon; and

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

c. No sulfuric horizon that has its upper boundary within 150 cm of the mineral soil surface.

Aridisols"

Page 95, right column, Definition of Alfisols. Replace item 2 with the following:

"2. Do not have an aridic soil moisture regime nor a salic horizon and saturation with water in one or more layers within 100 cm of the soil surface for 1 month or more per year in 6 out of 10 years."

Page 96, left column, Limits between Alfisols and soils of other orders. Replace item 2 (refer to NSTH page 615-179) to read as follows:

"2. To distinguish Alfisols from Aridisols, Alfisols do not have:

a. An aridic moisture regime and;

b. Both a salic horizon and saturation with water in one or more layers within 100 cm of the soil surface for 1 month or more per year in 6 out of 10 years."

Page 109, left column. Change IC. (refer to page 615-179) to read as follows:

"IC. Other Alfisols that have an ustic moisture regime."

And change ID. (refer to page 615-179) to read as follows:

"ID. Other Alfisols that have a xeric moisture regime."

Page 137, right column. Definition of Ustalfs. Change item 3 to read as follows:

"3. Have an ustic moisture regime."

Page 139, right column, line 57. Delete "soft powdery lime" and replace with "identifiable secondary carbonates".

Page 140, left column, line 20. Replace sentence beginning "A soil" with the following:

"A soil moisture regime that approaches the aridic regime is considered drier than normal and defines the aridic subgroups."

Page 140, left column, line 52. Delete "soft powdery lime" and replace with "identifiable secondary carbonates".

Page 140, right column, line 1. Delete "soft powdery lime" and replace with "identifiable secondary carbonates".

Page 140, right column. Delete lines 3 through the word "regime" in line 15.

Page 140, right column, line 29. Delete "soft powdery lime" and replace with "identifiable secondary carbonates".

Page 140, right column, line 55. Delete "soft powdery lime" and replace with "identifiable secondary carbonates".

Page 142, left column, lines 9. Change "Salorthids" to "Salids" and in line 39. Change "Salorthidic" to "Salidic"

Page 143, right column, line 58. Delete "soft powdery lime" and replace with "identifiable secondary carbonates".

Page 144, left column, lines 25. Change "Calciorthids" to "Calciargids"

Page 144, left column, left column, line 27 delete "or that is aridic"

Page 144, left column, line 45. Delete "soft powdery lime"and replace with "identifiable secondary carbonates".

Page 144, left column, line 58. Delete "soft powdery lime" and replace with "identifiable secondary carbonates".

Page 144, right column, line 6. Delete "soft powdery lime" and replace with "identifiable secondary carbonates".

Page 144, right column, line 16. Delete "soft powdery, secondary lime" and replace with "identifiable secondary carbonates".

Page 144, right column, line 39. Change "Calciorthidic" to "Calciargidic"

Page 145, left column, line 3. Delete "soft, powdery secondary lime" and replace with "identifiable secondary carbonates".

Page 145, left column, line 25. Delete "soft powdery lime" and replace with "identifiable secondary carbonates".

Page 145, left column, line 31. Delete "soft powdery lime" and replace with "identifiable secondary carbonates".

Page 145, left column, line 36. Delete "soft powdery lime" and replace with "identifiable secondary carbonates".

Page 146, left column, line 43. Delete "soft powdery lime" and replace with "identifiable secondary carbonates".

Page 146, left column, line 58. Delete "soft powdery lime" and replace with "identifiable secondary carbonates".

Page 146, right column, line 3. Delete "soft powdery lime" and replace with "identifiable secondary carbonates".

Page 146, right column, Definition of Xeralfs. Change number 1 to read

"1. Have a xeric moisture regime;"

NSTH 615.62, p. 615-305, JEEO. (see 615.89, p. 615-483). Delete "soft powdery lime" and replace with "identifiable secondary carbonates".

NSTH 615.62, p. 615-305, Definition of Typic Xerochrepts, item 6. Delete "soft powdery lime" and replace with "identifiable secondary carbonates".

Page 155, Aridisols. Delete entire chapter on Aridisols and replace with the following:

Chapter 10

Aridisols

Aridisols, as their name implies, are soils that do not have water available to mesophytic plants for long periods. During most of the time when the soil is warm enough for plants to grow, soil water is held at potentials less than permanent wilting point or it is salty, or both. There is no period of 90 consecutive days when moisture is continuously available for plant growth.

The concept of Aridisols is based on the low availability of soil moisture for sustained plant performance. In areas bordering deserts, the absolute precipitation may be high but due to runoff or a very low storage capacity of the soil or both, the actual soil moisture regime is aridic.

Soil moisture and to a lesser extent soil temperature regimes control processes in soils. In other Orders, soil moisture regimes are used at the suborder level or lower categories but in the Order of Aridisols, it is used to define the Order category. This produces a rather homogeneous class defined by a limited number of processes and this also eliminates a number of other processes or these processes have a minimal expression in such soils. As the soil moisture regime is also the single most important constraint in the utilization of these soils, this Order delineates geographic areas based on this constraint.

Having employed the major control of processes at the Order level, it provides the facility to use other diagnostic criteria for the lower categories. In the other Orders, soil moisture and temperature regimes are an important control of processes and these are brought in at the suborder or lower categoric levels.

Many Aridisols, due to an extreme imbalance between evapotranspiration and precipitation, are in a sense incipient evaporites. The dominant process is one of accumulation and concentration of weathering products. The high precipitate concentration is the second most important constraint to the use of the soil. Many soluble precipitates may be eliminated or changed in concentration through irrigation. In Aridisols, however, availability of adequate quality irrigation water is a fundamental problem; secondly, together with irrigation, a mechanism for evacuation of the soluble precipitates must be provided or there would be a rapid build up of salinity and/or sodicity. Thirdly, irrigation and drainage systems must be well maintained to prevent the soils from reverting to the original state.

The classification of Aridisols must include these constraints or performance restrictive qualities, at a high categoric level. Some Aridisols are also situated on geologic evaporites. It is frequently difficult to bring in these substratum conditions into a classification system but care must be taken to evaluate these deep seated salt accumulations particularly in irrigation projects.

Some Aridisols also present inherited features such as argillic horizons, which may be attributed to past wetter paleo-climatic conditions. However, there is evidence that clay illuviation has also occurred during the Holocene. These attributes, and specifically an argillic horizon, should also be considered as they are important for use and management of soils.

The suborders reflect the results of dominant soil forming processes. Unlike many other soils, the redistribution of soluble materials and their accumulation in some layer in the soil, is a dominant process in Aridisols. The products of this process not only give special attributes which distinguish the soils but also present constraints to use of the soil. Four of the seven suborders are defined on the composition and accumulation of the soluble fraction. Processes of weathering and clay translocation also take place in Aridisols. The fifth and seventh suborders reflect these processes. The seven suborders are:

1. Cryids - Aridisols of cold areas
2. Salids - accumulation of salts more soluble than gypsum
3. Durids - accumulation of silica
4. Gypsids - accumulation of gypsum
5. Argids - accumulation of clay
6. Calcids - accumulation of carbonates
7. Cambids - translocation and/or transformation of material

At the great group level, the degree of expression of the horizons of accumulation, and/or the results of other processes which are considered subordinate to the particular suborder, are employed. The defining element is the degree of expression of the diagnostic horizon with associated features. The `haplic' is the catch-all until this is deemed inappropriate and there is sufficient data to make changes.

Definition

Aridisols are mineral soils which:

1. Have an aridic soil moisture regime or a salic horizon and saturation with water in one or more layers within 100 cm of the soil surface for 1 month or more per year in 6 out of 10 years; and

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

3. Do not have a spodic horizon, nor an Ap horizon consisting of spodic materials;

4. Do not have andic soil properties in 60 percent or more of the thickness between either the mineral soil surface, or the top of an organic layer with andic soil properties, whichever is shallower, and a depth of 60 cm or a lithic or paralithic contact, duripan, or petrocalcic horizon, whichever is shallower;

5. Within 150 cm of the mineral surface have neither an oxic horizon, nor a kandic horizon that meets the weatherable-mineral requirements for an oxic horizon and also 40 percent or more clay in the surface 18 cm after mixing;

6. Do not have all of the following:

a. A layer 25 cm or more thick, with an upper boundary within 100 cm of the mineral surface, that either has slickensides close enough to intersect or wedge-shaped aggregates which have their long axes tilted 10 to 60 degrees from the horizontal; and

b. A weighted average of 30 percent or more clay in the fine-earth fraction either between the mineral soil surface and a depth of 18 cm or an Ap horizon, whichever is thicker, and 30 percent or more clay in the fine-earth fraction of all horizons between a depth of 18 cm and either a depth of 50 cm, or a lithic or paralithic contact, duripan, or petrocalcic horizon if shallower; and

c. Open cracks in some or most years.

Key to suborders

FA. Aridisols that have a cryic soil temperature regime.
Cryids

FB. Other Aridisols which have a salic horizon that has its upper boundary within 100 cm of the soil surface.
Salids

FC. Other Aridisols which have a duripan that has its upper boundary within 100 cm of the soil surface.
Durids

FD. Other Aridisols which have a gypsic or petrogypsic horizon that has its upper boundary within 100 cm of the soil surface and lack a petrocalcic horizon overlying any of these horizons.
Gypsids

FE. Other Aridisols which have an argillic or natric horizon that has its upper boundary within 100 cm of the soil surface and do not have a petrocalcic horizon that has an upper boundary within 100 cm of the soil surface.
Argids

FF. Other Aridisols which have a calcic or petrocalcic horizon that has its upper boundary within 100 cm of the soil surface.
Calcids

FG. Other Aridisols.
Cambids

Argids

These are the Aridisols that have an argillic or natric horizon, but not a duripan, gypsic, petrocalcic, petrogypsic, or salic horizon within 100 cm of the soil surface. The low water flux and high concentration of salts in many Aridisols hinders clay illuviation. The presence of an argillic horizon is often attributed to a moister paleo-climate, although there is evidence that clay illuviation has occurred during the Holocene in arid soils. Where the soil moisture regime grades to ustic or xeric, evidence of clay translocation is often more readily established.

Definition

Argids are the Aridisols which:

1. Have a natric or argillic horizon that has its upper boundary within 100 cm of the soil surface;

2. Have a soil temperature regime warmer than cryic;

3. Do not have a duripan or gypsic, petrocalcic, petrogypsic or salic horizon that has its upper boundary within 100 cm of the soil surface.

Argids

Key to great groups

FEA. Argids which have a duripan or a petrocalcic or petrogypsic horizon that has its upper boundary within 150 cm of the soil surface.
Petroargids

FEB. Other Argids that have a natric horizon.
Natrargids

FEC. Other Argids which do not have a lithic or paralithic contact within 50 cm of the soil surface, and have either:

1. A clay increase of 15 percent or more (absolute) within a vertical distance of 2.5 cm either within the argillic horizon or at its upper boundary; or

2. An argillic horizon that extends to 150 cm or more from the soil surface, that does not have a clay decrease with increasing depth of 20 percent or more (relative) from the maximum clay content, and has, in 50 percent or more of the matrix, in some part between 100 and 150 cm either:

a. Hues of 7.5YR or redder and chroma of 5 or more; or

b. Hues of 7.5YR or redder and value, moist, that is 3 or less and value, dry, that is 4 or less.
Paleargids

FED. Other Argids which have a gypsic horizon that has its upper boundary within 150 cm of the soil surface.
Gypsiargids

FEE. Other Argids which have a calcic horizon that has its upper boundary within 150 cm of the soil surface.
Calciargids

FEF. Other Argids.
Haplargids

Calciargids

These are the Argids that have a calcic horizon below the argillic horizon, but within 150 cm of the soil surface. These soils have been recharged with calcium carbonate from dust. The Calciargids are commonly on late-Pleistocene erosional surfaces or sediments that have gentle to steep slopes.

Definition

Calciargids are the Argids which:

1. Have a calcic horizon that has its upper boundary within 150 of the soil surface;

2. Do not have a natric horizon;

3. Do not have a duripan or gypsic, petrocalcic, or petrogypsic horizon that has its upper boundary within 150 cm of the soil surface;

4. Have a lithic or paralithic contact within 50 cm of the soil surface or:

a. A clay increase of less than 15 percent (absolute) within a vertical distance of 2.5 cm either within the argillic horizon or at its upper boundary or

b. An argillic horizon that does not extend to 150 cm from the soil surface, has a clay decrease with increasing depth of 20 percent or more (relative) from the maximum clay content or has either:

(1). Hues of 10YR or yellower or chroma of 4 or less in the matrix of all horizons between 100 and 150 cm; or

(2). Hues of 10YR or yellower and value, moist, that is 4 or more or value, dry, that is 4 or less in less than 50 percent of the matrix.

Key to subgroups

FEEA. Calciargids that have a lithic contact within 50 cm of the soil surface.

Lithic Calciargids

FEEB. Other Calciargids which have both:

1. One or both of the following:

a. Cracks within 125 cm of the 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 soil surface; or

b. A linear extensibility of 6.0 cm or more between the soil surface and either a depth of 100 cm or to a lithic or paralithic contact, if shallower; and

2. A moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the soil moisture regime borders a xeric regime.

Xerertic Calciargids

FEEC. Other Calciargids which have both:

1. One or both of the following:

a. Cracks within 125 cm of the 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 soil surface; or

b. A linear extensibility of 6.0 cm or more between the soil surface and either a depth of 100 cm or to a lithic or paralithic contact, if shallower; and

2. A moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders an ustic regime.

Ustertic Calciargids

FEED. Other Calciargids that have one or both of the following:

1. Cracks within 125 cm of the 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 soil surface; or

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

Vertic Calciargids

FEEE. Other Calciargids that are either:

1. Irrigated and have aquic conditions, for some time in most years, in one or more layers within 100 cm of the soil surface; or

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

Aquic Calciargids

FEEF. Other Calciargids which have:

1. A sandy particle size throughout a layer extending from the soil surface to the top of an argillic horizon at a depth of 50 cm or more; and

2. A moisture control section that is dry in all its parts for less than three-fourths of the time (cumulative) when the soil temperature at a depth of 50 cm is 5°C or higher and the moisture regime borders on an ustic regime.

Arenic Ustic Calciargids

FEEG. Other Calciargids which have a sandy particle size throughout a layer extending from the soil surface to the top of an argillic horizon at a depth of 50 cm or more.

Arenic Calciargids

FEEH. Other Calciargids that have the following combination of characteristics:

1. One or more horizons, within 100 cm of the soil surface, that have a combined thickness of 15 cm or more, that contain 20 percent or more (by volume) durinodes or are brittle and have at least a firm rupture resistance class when moist; and

2. Are dry in all parts of the moisture control section for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders on a xeric regime.

Durinodic Xeric Calciargids

FEEI. Other Calciargids which have one or more horizons, within 100 cm of the soil surface, that have a combined thickness of 15 cm or more, that contain 20 percent or more (by volume) durinodes or are brittle and have at least a firm rupture resistance class when moist.

Durinodic Calciargids

FEEJ. Other Calciargids which have one or more horizons, within 100 cm of the soil surface, that have a combined thickness of 15 cm or more, that contain 20 percent or more (by volume) nodules or concretions.

Petronodic Calciargids

FEEK. Other Calciargids that have *both*:

1. A moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders a xeric regime; *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 of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

Vitrixerandic Calciargids

FEEL. Other Calciargids which 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:

1. 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*

2. A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

Vitrandic Calciargids

FEEM. Other Calciargids that are dry in all parts of the moisture control section less than three-fourths of the time (cumulative) when the soil temperature at a depth of 50 cm is 5°C or higher and the moisture regime borders on a xeric regime.

Xeric Calciargids

FEEN. Other Calciargids that are dry in all parts of the moisture control section less than three-fourths of the time (cumulative) when the soil temperature at a depth of 50 cm is 5°C or higher and the moisture regime borders on an ustic regime.

Ustic Calciargids

FEEO. Other Calciargids.

Typic Calciargids

Definition of Typic Calciargids

Typic Calciargids are the Calciargids that:

1. Do not have a lithic contact within 50 cm of the soil surface;

2. Are not both irrigated and have aquic conditions, for some time in most years, in one or more layers within 100 cm of the soil surface; nor are they saturated with water, in one or more layers within 100 cm of the soil surface, for 1 month or more per year in 6 or more out of 10 years.

3. Do not have one or more horizons, within 100 cm of the soil surface, that have a combined thickness of more than 15 cm and that contain 20 percent or more (by volume) durinodes, nodules, or concretions or are brittle and have at least firm rupture resistance class when moist;

4. Are dry in all parts of the moisture control section for three-fourths of the time (cumulative) or more that the soil temperature is 5°C or higher at a depth of 50 cm or the soil moisture regime does not border on an ustic or xeric regime;

5. Do not have a sandy particle size in all layers extending from the soil surface to the top of an argillic horizon at a depth of 50 cm or more;

6. Have either:

a. No cracks within 125 cm of the soil surface that are 5 mm or more wide through a thickness of 30 cm or more for some time in most years, and no slickensides, nor wedge-shaped aggregates, in a layer 15 cm or more thick that has its upper boundary within 125 cm of the soil surface; or

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

7. Do not have throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the soil surface, either 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 of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

Gypsiargids

Gypsiargids are the Argids that have a gypsic horizon within 150 cm of the soil surface. Most of these are on late-Pleistocene surfaces. They are of minor extent and are known to occur in northwestern New Mexico and possibly other states in the Four Corners Area.

Definition

Gypsiargids are the Argids that:

1. Have a gypsic horizon that has its upper boundary within 150 cm of the soil surface;

2. Do not have a duripan or a petrocalcic or petrogypsic horizon that has its upper boundary within 150 cm of the soil surface;

3. Do not have a natric horizon;

4. Have a lithic or paralithic contact within 50 cm of the soil surface or:

a. A clay increase of less than 15 percent (absolute) within a vertical distance of 2.5 cm either within the argillic horizon or at its upper boundary or

b. An argillic horizon that does not extend to 150 cm from the soil surface, has a clay decrease with increasing depth of 20 percent or more (relative) from the maximum clay content or has either:

(1). Hues of 10YR or yellower or chroma of 4 or less in the matrix of all horizons between 100 and 150 cm; or

(2). Hues of 10YR or yellower and value, moist, that is 4 or more or value, dry, that is 4 or less in less than 50 percent of the matrix.

Key to subgroups

FEDA. Gypsiargids that are either:

1. Irrigated and have aquic conditions, for some time in most years, in one or more layers within 100 cm of the soil surface; or

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

Aquic Gypsiargids

FEDB. Other Gypsiargids which have one or more horizons, within 100 cm of the soil surface, that have a combined thickness of 15 cm or more, that either contains 20 percent or more (by volume) durinodes or have brittle and has at least a firm rupture resistance class when moist.

Durinodic Gypsiargids

FEDC. Other Gypsiargids that have *both*:

1. A moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders a xeric regime; *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 of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

Vitrixerandic Gypsiargids

FEDD. Other Gypsiargids which 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:

1. 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*

2. A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

Vitrandic Gypsiargids

FEDE. Other Gypsiargids that are dry in all parts of the *moisture control section less than three-fourths* of the time (cumulative) when the soil temperature at a depth of 50 cm is 5°C or higher and the moisture regime borders on a xeric regime.

Xeric Gypsiargids

FEDF. Other Gypsiargids that are dry in all parts of the moisture control section for less then three-fourths of the time (cumulative) that the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders on an ustic regime.

Ustic Gypsiargids

FEDG. Other Gypsiargids.

Typic Gypsiargids

Definition of Typic Gypsiargids

Typic Gypsiargids are the Gypsiargids that:

1. Are not both irrigated and have aquic conditions, for some time in most years, in one or more layers within 100 cm of the soil surface; nor are they saturated with water, in one or more layers within 100 cm of the soil surface, for 1 month or more per year in 6 or more out of 10 years;

2. Do not have one or more horizons, within 100 cm of the soil surface, that have a combined thickness of more than 15 cm and that contains 20 percent or more (by volume) durinodes or are brittle and have at least firmrupture resistance class when moist;

3. Are dry in all parts of the moisture control section three-fourths of the time (cumulative) or more when the soil temperature at a depth of 50 cm is 5°C or higher, or do not have moisture regimes that border on ustic or xeric;

4. Do not have throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the soil surface, either 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 of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

Haplargids

These are the Argids that have an argillic horizon, but do not have a duripan or a petrocalcic, petrogypsic, calcic, gypsic, or natric horizon. These soils often have calcium carbonate accumulations below the argillic horizon, but the accumulations are insufficient to meet the requirements of a calcic horizon. Haplargids commonly occur on late-Pleistocene surfaces or sediments.

Definition

Haplargids are the Argids that:

1. Do not have a duripan or a petrocalcic, petrogypsic, gypsic, or calcic horizon that has an upper boundary within 150 cm of the soil surface;

2. Do not have a natric horizon;

3. Have a lithic or paralithic contact within 50 cm of the soil surface or:

a. A clay increase of less than 15 percent (absolute) within a vertical distance of 2.5 cm either within the argillic horizon or at its upper boundary or

b. An argillic horizon that does not extend to 150 cm from the soil surface, has a clay decrease with increasing depth of 20 percent or more (relative) from the maximum clay content or has either:

(1). Hues of 10YR or yellower or chroma of 4 or less in the matrix of all horizons between 100 and 150 cm; or

(2). Hues of 10YR or yellower and value, moist, that is 4 or more or value, dry, that is 4 or less in less than 50 percent of the matrix.

Key to subgroup

FEFA. Haplargids which have:

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

2. An argillic horizon that is discontinuous throughout each pedon.

Lithic Ruptic-Entic Haplargids

FEFB. Other Haplargids which have:

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

2. A moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the soil moisture regime borders on a xeric regime.

Lithic Xeric Haplargids

FEFC. Other Haplargids which have:

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

2. A moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders on an ustic regime.

Lithic Ustic Haplargids

FEFD. Other Haplargids which have a lithic contact within 50 cm of the soil surface.

Lithic Haplargids

FEFE. Other Haplargids which have both:

1. One or both of the following:

a. Cracks within 125 cm of the 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 soil surface; or

b. A linear extensibility of 6.0 cm or more between the soil surface and either a depth of 100 cm or to a lithic or paralithic contact, if shallower; and

2. A moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders on a xeric regime.

Xerertic Haplargids

FEFF. Other Haplargids which have both:

1. One or both of the following:

a. Cracks within 125 cm of the 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 soil surface; or

b. A linear extensibility of 6.0 cm or more between the soil surface and either a depth of 100 cm or to a lithic or paralithic contact, if shallower; and

2. A moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders on an ustic regime.

Ustertic Haplargids

FEFG. Other Haplargids that have one or both of the following:

1. Cracks within 125 cm of the 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 soil surface; or

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

Vertic Haplargids

FEFH. Other Haplargids that are either:

1. Irrigated and have aquic conditions, for some time in most years, in one or more layers within 100 cm of the soil surface; *or*

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

Aquic Haplargids

FEFI. Other Haplargids which have:

1. A sandy particle size throughout a layer extending from the soil surface to the top of an argillic horizon at a depth of 50 cm or more; and

2. A moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature at a depth of 50 cm is 5°C or higher and the moisture regime borders an ustic regime.

Arenic Ustic Haplargids

FEFJ. Other Haplargids which have a sandy particle size throughout a layer extending from the soil surface to the top of an argillic horizon at a depth of 50 cm or more.

Arenic Haplargids

FEFK. Other Haplargids which have:

1. One or more horizons, within 100 cm of the soil surface, that have a combined thickness of 15 cm or more, that contain 20 percent or more (by volume) durinodes or are brittle and have at least a firm rupture resistance class when moist; and

2. A moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders a xeric regime.

Durinodic Xeric Haplargids

FEFL. Other Haplargids that have one or more horizons, within 100 cm of the soil surface, that have a combined thickness of 15 cm or more, that contain 20 percent or more (by volume) durinodes or are brittle and have at least a firm rupture resistance class when moist.

Durinodic Haplargids

FEFM. Other Haplargids which have one or more horizons, within 100 cm of the soil surface, that have a combined thickness of 15 cm or more, that contain 20 percent or more (by volume) nodules or concretions.

Petronodic Haplargids

FEFN. Other Haplargids that have *both*:

1. A moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders a xeric regime; *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 of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

Vitrixerandic Haplargids

FEFO. Other Haplargids that which 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:

1. 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*

2. A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter of which 5 percent or more is volcanic glass, and [(Al plus

1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

Vitrandic Haplargids

FEFP. Other Haplargids that are dry in all parts of the moisture control section less than three-fourths of the time (cumulative) when the soil temperature at a depth of 50 cm is 5°C or higher and the moisture regime borders a xeric regime.

Xeric Haplargids

FEFQ. Other Haplargids that are dry in all parts of the moisture control section for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders an ustic regime.

Ustic Haplargids

FEFR. Other Haplargids.

Typic Haplargids

Definition of Typic Haplargids

Typic Haplargids are the Haplargids which:

1. Do not have a lithic contact within 50 cm of the soil surface;

2. Have an argillic horizon that is continuous throughout each pedon;

3. Have a moisture control section that is dry in all parts for three-fourths of the time (cumulative) or more when the soil temperature is 5°C or higher at a depth of 50 cm or do not have a moisture regime that borders an ustic or a xeric regime;

4. Have:

   a. No cracks within 125 cm of the soil surface that are 5 mm or more wide through a thickness of 30 cm or more for some time in most years, or no slickensides or wedge-shaped aggregates in a layer 15 cm or more thick that has its upper boundary within 125 cm of the soil surface; and

   b. A linear extensibility of less than 6.0 cm between the soil surface and either a depth of 100 cm or to a lithic or paralithic contact, if shallower;

5. Are not both irrigated and have aquic conditions, for some time in most years, in one or more layers within 100 cm of the soil surface; nor are they saturated with water, in one or more layers within 100 cm of the soil surface, for 1 month or more per year in 6 or more out of 10 years;

6. Do not have a sandy particle size in all layers extending from the soil surface to the top of an argillic horizon at a depth of 50 cm or more;

7. Do not have one or more horizons, within 100 cm of the soil surface, that have a combined thickness of more than 15 cm and that contain 20 percent or more (by volume) durinodes, nodules, or concretions or are brittle and have at least firm rupture resistance class when moist;

8. Do not have throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the soil surface, either 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 of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

Natrargids

These are the Argids that have a natric horizon, but do not have a duripan or petrocalcic or petrogypsic horizon within 150 cm of the soil surface. Often the natric horizon has prismatic or columnar structure. Natrargids commonly have carbonates, soluble salts, or both. These soils have formed in sediments that range in age from the Holocene to the late-Pleistocene. Most of them are nearly level to gently sloping. These soils occur in western states and the western edge of the Great Plains.

Definition of Natrargids

Natrargids are the Argids which:

1. Have a natric horizon;

2. Do not have a duripan or petrocalcic or petrogypsic horizon that has its upper boundary within 150 cm of the soil surface.

Key to subgroups

FEBA. Natrargids which have both of the following:

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

2. A moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders a xeric regime.

Lithic Xeric Natrargids

FEBB. Natrargids which have both of the following:

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

2. A moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders an ustic regime.

Lithic Ustic Natrargids

FEBC. Other Natrargids that have a lithic contact within 50 cm of the soil surface.

Lithic Natrargids

FEBD. Other Natrargids which have one or both of the following:

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

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

Vertic Natrargids

FEBE. Other Natrargids that are either:

1. Irrigated and have aquic conditions, for some time in most years, in one or more layers within 100 cm of the soil surface; *or*

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

Aquic Natrargids

FEBF. Other Natrargids that have both of the following:

1. One or more horizons, within 100 cm of the soil surface, that have a combined thickness of 15 cm or more, that contain 20 percent or more (by volume)

durinodes or are brittle and have at least a firm rupture resistance class when moist; and

2. Are dry in all parts of the moisture control section for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders a xeric regime.

Durinodic Xeric Natrargids

FEBG. Other Natrargids that have one or more horizons, within 100 cm of the soil surface, that have a combined thickness of 15 cm or more, that contain 20 percent or more (by volume) durinodes or are brittle and have at least a firm rupture resistance class when moist.

Durinodic Natrargids

FEBH. Other Natrargids which have one or more horizons, within 100 cm of the soil surface, that have a combined thickness of 15 cm or more, that contain 20 percent or more (by volume) nodules or concretions.

Petronodic Natrargids

FEBI. Other Natrargids that have:

1. Skeletans covering 10 percent or more of the surfaces of peds at a depth 2.5 cm or more below the upper boundary of the natric horizon; and

2. A moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders an ustic regime.

Glossic Ustic Natrargids

FEBJ. Other Natrargids that have:

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. A moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders an ustic regime.

Haplic Ustic Natrargids

FEBK. Other Natrargids that have:

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. A moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders a xeric regime.

Haploxeralfic Natrargids

FEBL. Other Natrargids that have 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.

Haplic Natrargids

FEBM. Other Natrargids that have *both*:

1. A moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders a xeric regime; *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 of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

Vitrixerandic Natrargids

FEBN. Other Natrargids which 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:

1. 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*

2. A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

Vitrandic Natrargids

FEBO. Other Natrargids that are dry in all parts of the moisture control section less than three-fourths of the time (cumulative) when the soil temperature at a depth of 50 cm is 5°C or higher and the moisture regime borders a xeric regime.

Xeric Natrargids

FEBP. Other Natrargids that are dry in all parts of the moisture control section less than three-fourths of the time (cumulative) when the soil temperature at a depth of 50 cm is 5°C or higher and the moisture regime borders an ustic regime.

Ustic Natrargids

FEBQ. Other Natrargids which have skeletans covering 10 percent or more of the surfaces of peds at a depth 2.5 cm or more below the upper boundary of the natric horizon.

Glossic Natrargids

FEBR. Other Natrargids.

Typic Natrargids

Definition of Typic Natrargids

Typic Natrargids are the Natrargids which:

1. Do not have a lithic contact within 50 cm of the soil surface;

2. Have either:

a. No cracks within 125 cm of the soil surface that are 5 mm or more wide through a thickness of 30 cm or more for some time in most years, and no slickensides, nor wedge-shaped aggregates, in a layer 15 cm or more thick that has its upper boundary within 125 cm of the soil surface; or

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

3. Are not both irrigated and have aquic conditions, for some time in most years, in one or more layers within 100 cm of the soil surface; nor are they saturated with water, one or more layers within 100 cm of the soil surface, for 1 month or more per year in 6 or more out of 10 years;

4. Do not have one or more horizons, within 100 cm of the soil surface, that have a combined thickness of more than 15 cm and that contain 20 percent or more (by volume) durinodes, nodules, or concretions or are brittle and have at least firm rupture resistance class when moist;

5. Are dry in all parts of the moisture control section for three-fourths of the time (cumulative) or more when the soil temperature is 5°C or higher at a depth of 50 cm or do not have a moisture regime that borders an ustic or a xeric regime;

6. Have skeletans covering less than 10 percent of the surfaces of peds at a depth 2.5 cm or more below the upper boundary of the natric horizon;

7. Have 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 throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the soil surface, either 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 of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

Paleargids

These are the Argids on stable land surfaces that have an abrupt textural change or a clay distribution that does not decrease significantly. Most formed in sediments appreciably older than late-Pleistocene. If calcareous dust is present, some of these soils may be calcareous in all horizons. Slopes are normally gentle.

Definition of Paleargids

Paleargids are the Argids which:

1. Do not have a lithic or paralithic contact within 50 cm of the soil surface and that have either:

a. A clay increase of 15 percent or more (absolute) within a vertical distance of 2.5 cm either within the argillic horizon or at its upper boundary; or

b. An argillic horizon that extends to 150 cm or more from the soil surface, that does not have a clay decrease with increasing depth of 20 percent or more (relative) from the maximum clay content and has, in 50 percent or more of the matrix, in some part between 100 and 150 cm either:

(1). Hues of 7.5YR or redder and chroma of 5 or more; or

(2). Hues of 7.5YR or redder and value, moist, that is 3 or less and value, dry, that is 4 or less; and

2. Do not have a duripan or petrocalcic or petrogypsic horizon that has its upper boundary within 150 cm of the soil surface; and

3. Do not have a natric horizon.

Key to subgroups

FECA. Paleargids that have one or both of the following:

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

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

Vertic Paleargids

FECB. Other Paleargids that are either:

1. Irrigated and have aquic conditions, for some time in most years, in one or more layers within 100 cm of the soil surface; *or*

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

Aquic Paleargids

FECC. Other Paleargids that have:

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

2. A moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders an ustic regime.

Arenic Ustic Paleargids

FECD. Other Paleargids that have a sandy particle size throughout a layer extending from the mineral soil surface to the top of an argillic horizon at a depth of 50 cm or more.

Arenic Paleargids

FECE. Other Paleargids which have a calcic horizon that has its upper boundary within 150 cm of the soil surface.

Calcic Paleargids

FECF. Other Paleargids that have:

1. One or more horizons, within 100 cm of the soil surface, that have a combined thickness of 15 cm or more, that contain 20 percent or more (by volume) durinodes or are brittle and have at least a firm rupture resistance class when moist; and

2. A moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders a xeric regime.

Durinodic Xeric Paleargids

FECG. Other Paleargids that have one or more horizons, within 100 cm of the soil surface, that have a combined thickness of 15 cm or more, that contain 20 percent or more (by volume) durinodes or are brittle and have at least a firm rupture resistance class when moist.

Durinodic Paleargids

FECH. Other Paleargids which have one or more horizons, within 100 cm of the soil surface, that have a combined thickness of 15 cm or more, that contain 20 percent or more (by volume) nodules or concretions.

Petronodic Paleargids

FECI. Other Paleargids that have *both*:

1. A moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders a xeric regime; *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 of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) *times* 60] plus the volcanic glass (percent) is 30 or more.

Vitrixerandic Paleargids

FECJ. Other Paleargids 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:

1. 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*

2. A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

Vitrandic Paleargids

FECK. Other Paleargids that are dry in all parts of the moisture control section for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders a xeric regime.

Xeric Paleargids

FECL. Other Paleargids that are dry in all parts of the moisture control section for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders an ustic regime.

Ustic Paleargids

FDCM. Other Paleargids.

Typic Paleargids

Definition of Typic Paleargids

Typic Paleargids are the Paleargids which:

1. Have both of the following:

a. No cracks within 125 cm of the soil surface that are 5 mm or more wide through a thickness of 30 cm or more for some time in most years, and no slickensides, or wedge-shaped aggregates, in a layer 15 cm or more thick that has its upper boundary within 125 cm of the soil surface; and

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

2. Are not both irrigated and have aquic conditions, for some time in most years, in one or more layers within 100 cm of the soil surface nor are they saturated with water, in one or more layers within 100 cm of the soil surface, for 1 month or more per year in 6 or more out of 10 years;

3. Do not have a sandy particle size throughout a layer extending from the mineral soil surface to the top of an argillic horizon at a depth of 50 cm or more;

4. Have a moisture control section that is dry in all parts for three-fourths of the time (cumulative) or more when the soil temperature is 5°C or higher at a depth of 50 cm or the soil moisture regime does not border an ustic or a xeric regime;

5. Do not have a calcic horizon that has its upper boundary within 150 cm of the soil surface;

6. Do not have one or more horizons, within 100 cm of the soil surface, that have a combined thickness of more than 15 cm and that contains 20 percent or more (by volume) durinodes, nodules, or concretions or are brittle and have at least firm rupture resistance class when moist;

7. Do not have throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the soil surface, either 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 of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

Petroargids

These are the Argids which have a duripan or a petrocalcic or petrogypsic horizon that has its upper boundary between 100 and 150 cm of the soil surface. These soils occur on stable landscapes in the western United States.

Definition of Petroargids

These are the Argids which have a duripan or a petrocalcic or petrogypsic horizon that has its upper boundary within 150 cm of the soil surface.

Key to subgroups

FEAA. Petroargids which have both of the following:

1. A petrogypsic horizon that has its upper boundary within 150 cm of the soil surface; and

2. Are dry in all parts of the moisture control section for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders an ustic regime.

Petrogypsic Ustic Petroargids

FEAB. Other Petroargids which have a petrogypsic horizon that has its upper boundary within 150 cm of the soil surface.

Petrogypsic Petroargids

FEAC. Other Petroargids which have:

1. A duripan that has its upper boundary within 150 cm of the soil surface; and

2. A moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders a xeric regime.

Duric Xeric Petroargids

FEAD. Other Petroargids which have a duripan that has its upper boundary within 150 cm of the soil surface.

Duric Petroargids

FEAE. Other Petroargids which have a moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the soil moisture regime borders a xeric regime.

Xeric Petroargids

FEAF. Other Petroargids which have a moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders an ustic regime.

Ustic Petroargids

FEAG. Other Petroargids.

Typic Petroargids

Definition of Typic Petroargids

Typic Petroargids are the Petroargids which:

1. Have a petrocalcic horizon that has its upper boundary within 150 cm of the soil surface;

2. Are dry in all parts of the moisture control section for three-fourths of the time (cumulative) or more when the soil temperature is 5°C or higher at a depth of 50 cm or the moisture regime does not border an ustic or a xeric regime;

3. Do not have a duripan or a petrogypsic horizon that has its upper boundary within 150 cm of the soil surface.

Calcids

Calcids are the Aridisols that have calcium carbonate in the parent materials or added as dust or both. Precipitation is insufficient to leach or even move the carbonates to great depths. The upper boundary of the calcic or petrocalcic horizon is normally within 50 cm of the soil surface. If these soils are irrigated and cultivated micro-nutrient deficiencies are normal. These soils are extensive in the western United States as well as other arid regions of the world.

Definition

Calcids are the Aridisols which:

1. Have a petrocalcic or a calcic horizon that has its upper boundary within 100 cm of the soil surface and no argillic or natric horizon with its upper boundary within 100 cm of the soil surface, unless a petrocalcic horizon is within 100 cm of the soil surface;

2. Have a temperature regime warmer than cryic;

3. Do not have a duripan or a salic, gypsic, or petrogypsic horizon that has its upper boundary within 100 cm of the soil surface.

Key to great groups

FFA. Calcids which have a petrocalcic horizon that has its upper boundary within 100 cm of the soil surface.
Petrocalcids

FFB. Other Calcids.
Haplocalcids

Haplocalcids

Haplocalcids are the Calcids that have a calcic horizon with its upper boundary within 100 cm of the soil surface. These soils do not have a duripan nor an argillic, natric, or petrocalcic horizons within 100 cm of the soil surface. Some of these soils have cambic horizons above the calcic horizon. The Haplocalcids are extensive.

Definition of Haplocalcids

Haplocalcids are the Calcids which:

1. Have a calcic horizon that has its upper boundary within 100 cm of the soil surface;

2. Do not have a petrocalcic horizon that has its upper boundary within 100 cm of the soil surface.

Key to subgroups

FFCA. Haplocalcids that have:

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

2. A moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders a xeric regime.
Lithic Xeric Haplocalcids

FFCB. Other Haplocalcids that have:

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

2. A moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders an ustic regime.
Lithic Ustic Haplocalcids

FFCC. Other Haplocalcids that have a lithic contact within 50 cm of the soil surface.
Lithic Haplocalcids

FFCD. Other Haplocalcids that have:

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

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

FFCE. Other Haplocalcids that:

1. Are either:

a. Irrigated and have aquic conditions, for some time in most years, in one or more layers within 100 cm of the soil surface; *or*

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

2. Have one or more horizons, within 100 cm of the soil surface, that have a combined thickness of 15 cm or more, that contain 20 percent or more (by volume) durinodes or are brittle and have at least a firm rupture resistance class when moist.
Aquic Durinodic Haplocalcids

FFCF. Other Haplocalcids that are either:

1. Irrigated and have aquic conditions, for some time in most years, in one or more layers within 100 cm of the soil surface; *or*

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

FFCH. Other Haplocalcids that have:

1. A duripan that has its upper boundary within 150 cm of the surface; and

2. A moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders a xeric regime.
Duric Xeric Haplocalcids

FFCI. Other Haplocalcids that have a duripan that has its upper boundary within 150 cm of the surface.
Duric Haplocalcids

FFCJ. Other Haplocalcids that have:

1. One or more horizons, within 100 cm of the soil surface, that have a combined thickness of 15 cm or more, that contain 20 percent or more (by volume)

durinodes or are brittle and have at least a firm rupture resistance class when moist; and

2. A moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders a xeric regime.

Durinodic Xeric Haplocalcids

FFCK. Other Haplocalcids that have one or more horizons, within 100 cm of the soil surface, that have a combined thickness of 15 cm or more, that contain 20 percent or more (by volume) durinodes or are brittle and have at least a firm rupture resistance class when moist.

Durinodic Haplocalcids

FFCL. Other Haplocalcids which have one or more horizons, within 100 cm of the soil surface, that have a combined thickness of 15 cm or more, that contain 20 percent or more (by volume) nodules or concretions.

Petronodic Haplocalcids

FFCM. Other Haplocalcids 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

2. A moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature at a depth of 50 cm is 5°C or higher and the moisture regime borders a xeric regime.

Sodic Xeric Haplocalcids

FFCN. Other Haplocalcids 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

2. Other Haplocambids that are dry in all parts of the moisture control section for less than three-fourths of the time (cumulative) when the soil temperature at a depth of 50 cm is 5°C or higher and the soil moisture regime borders an ustic regime.

Sodic Ustic Haplocalcids

FFCO. Other Haplocalcids that have, in one or more horizons within 100 cm of the mineral surface, an exchangeable sodium percentage of 15 or more (or a sodium adsorption ratio of 13 or more) for 6 or more months per year in 6 or more out of 10 years.

Sodic Haplocalcids

FFCP. Other Haplocalcids that have *both*:

1. A moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders a xeric regime; *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 of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

Vitrixerandic Haplocalcids

FFCQ. Other Haplocalcids which 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:

1. 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*

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 of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

Vitrandic Haplocalcids

FFCR. Other Haplocalcids that are dry in all parts of the moisture control section for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders a xeric regime.

Xeric Haplocalcids

FECS. Other Haplocalcids that are dry in all parts of the moisture control section for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders an ustic regime.

Ustic Haplocalcids

FECT. Other Haplocalcids.

Typic Haplocalcids

Definition of Typic Haplocalcids

Typic Haplocalcids are the Haplocalcids which:

1. Do not have a lithic contact within 50 cm of the soil surface;

2. Are dry in all parts of the moisture control section for three-fourths of the time (cumulative) or more when the soil temperature is 5°C or higher at a depth of 50 cm or do not have a moisture regime that borders an ustic or a xeric regime;

3. Have both of the following:

a. No cracks within 125 cm of the soil surface that are 5 mm or more wide through a thickness of 30 cm or more for some time in most years, and no slickensides, or wedge-shaped aggregates, in a layer 15 cm or more thick that has its upper boundary within 125 cm of the soil surface; and

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

4. Are not both irrigated and have aquic conditions, for some time in most years, in one or more layers within 100 cm of the soil surface nor are they saturated with water, in one or more layers within 100 cm of the soil surface, for 1 month or more per year in 6 or more out of 10 years;

5. Do not have one or more horizons, within 100 cm of the soil surface, that have a combined thickness of more than 15 cm and that contain 20 percent or more (by volume) durinodes, nodules, or concretions or are brittle and have at least firm rupture resistance class when moist;

6. Do not have, in one or more horizons within 100 cm of the mineral surface, an exchangeable sodium percentage of 15 or more (or a sodium adsorption ratio of 13 or more) for 6 or more months per year in 6 or more out of 10 years;

7. Do not have a duripan that has its upper boundary within 150 cm of the surface;

8. Do not have throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the soil surface, *either* 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 of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

Petrocalcids

Petrocalcids are the Calcids which have a petrocalcic horizon that has its upper boundary within 100 cm of the soil surface. Normally the upper boundary of the petrocalcic horizon is close to the soil surface. Some of these soils have evidence of former argillic horizons that are now engulfed with carbonates. Generally, these soils are on gentle slopes that have been stable for long periods of time. They occur on old landscapes in the southwestern U.S.

Definition of Petrocalcids

Petrocalcids are the Calcids which have a petrocalcic horizon that has its upper boundary within 100 cm of the soil surface.

Key to subgroups

FFAA. Petrocalcids that are either:

1. Irrigated and have aquic conditions, for some time in most years, in one or more layers within 100 cm of the soil surface; *or*

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

Aquic Petrocalcids

FFAB. Other Petrocalcids that have a natric horizon.

Natric Petrocalcids

FFAC. Other Petrocalcids which have both of the following:

1. An argillic horizon that has its upper boundary within 100 cm of the soil surface; *and*

2. A moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders a xeric regime.

Xeralfic Petrocalcids

FFAD. Other Petrocalcids which have both of the following:

1. An argillic horizon that has its upper boundary within 100 cm of the soil surface; *and*

2. A moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders an ustic regime.

Ustalfic Petrocalcids

FFAE. Other Petrocalcids which have an argillic horizon that has its upper boundary within 100 cm of the soil surface.

Argic Petrocalcids

FFAF. Other Petrocalcids that have a calcic horizon overlying the petrocalcic horizon.

Calcic Petrocalcids

FFAG. Other Petrocalcids that have *both*:

1. A moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders a xeric regime; *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 of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

Vitrixerandic Petrocalcids

FFAH. Other Petrocalcids which 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:

1. 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*

2. A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

Vitrandic Petrocalcids

FFAI. Other Petrocalcids that are dry in all parts of the moisture control section for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders a xeric regime.

Xeric Petrocalcids

FFAJ. Other Petrocalcids that are dry in all parts of the moisture control section for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders an ustic regime.

Ustic Petrocalcids

FFAK. Other Petrocalcids

Typic Petrocalcids

Definition of Typic Petrocalcids

Typic Petrocalcids are the Petrocalcids which:

1. Are not both irrigated and have aquic conditions, for some time in most years, in one or more layers within 100 cm of the soil surface nor are they saturated with water, in one or more layers within 100 cm of the soil surface, for 1 month or more per year in 6 or more out of 10 years;

2. Do not have a natric horizon;

3. Do not have an argillic horizon that has its upper boundary within 100 cm of the soil surface;

4. Do not have a calcic horizon overlying the petrocalcic horizon;

5. Have a moisture control section that is dry in all parts for three-fourths of the time (cumulative) or more when the soil temperature is 5°C or higher at a depth of 50 cm or do not have a moisture regime that borders an ustic or a xeric regime;

6. Do not have throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the soil surface, *either* 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 of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

Cambids

These are the Aridisols with the least degree of soil development. Cambids have a cambic horizon within 100 cm of the soil surface. These soils are permitted to have other diagnostic horizons such as petrocalcic, gypsic, or calcic horizons, but their upper boundary must be below 100 cm from the soil surface. Haplocambids are the most common of the Cambids in the United States.

Definition

Cambids are the Aridisols which:

1. Have a cambic horizon that has its upper boundary within 100 cm of the soil surface;

2. Have a soil temperature regime warmer than cryic;

3. Do not have a duripan or an argillic, calcic, natric, petrocalcic, gypsic, petrogypsic, or salic horizon that has its upper boundary within 100 cm of the soil surface.

Key to great groups

FGA. Cambids that are either:

1. Irrigated and have aquic conditions, for some time in most years, in one or more layers within 100 cm of the soil surface; *or*

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

Aquicambids

FGB. Other Cambids which have a duripan or a petrocalcic or petrogypsic horizon that has its upper boundary within 150 cm of the soil surface.

Petrocambids

FGC. Other Cambids that have an anthropic epipedon.

Anthracambids

FGD. Other Cambids.

Haplocambids

Anthracambids

These are the Cambids that have an anthropic epipedon. They are soils that have been irrigated for centuries. They are not known to occur in the United States, but the great group is provided for use elsewhere.

Key to subgroups

FGCA. All Anthracambids.

Typic Anthracambids

Definition of Typic Anthracambids

All Anthracambids are considered Typic.

Aquicambids

These are the Cambids that are saturated with water for short periods during most years. These soils often occur adjacent playas and have accumulations of salts in the profile. Aquicambids often have high pH values, which inhibit the formation of redoximorphic features.

Definition

Aquicambids are the Cambids that are either irrigated and have redoximorphic features in one or more layers within 100 cm of the soil surface or are saturated with water, in one or more layers within 100 cm of the soil surface, for 1 month or more per year in 6 or more out of 10 years.

Key to subgroups

FGAA. Aquicambids which have a horizon at least 25 cm thick within 100 cm of the soil surface, that have 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.

Sodic Aquicambids

FGAB. Other Aquicambids that have:

1. One or more horizons, within 100 cm of the soil surface, that have a combined thickness of 15 cm or more, that contain 20 percent or more (by volume) durinodes or are brittle and have at least a firm rupture resistance class when moist; and

2. Are dry in all parts of the moisture control section for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders a xeric regime.

Durinodic Xeric Aquicambids

FGAC. Other Aquicambids that have one or more horizons, within 100 cm of the soil surface, that have a combined thickness of 15 cm or more, that contain 20 percent or more (by volume) durinodes or are brittle and have at least a firm rupture resistance class when moist.

Durinodic Aquicambids

FGAD. Other Aquicambids which have one or more horizons, within 100 cm of the soil surface, that have a combined thickness of 15 cm or more, that contain 20 percent or more (by volume) nodules or concretions.

Petronodic Aquicambids

FGAE. Other Aquicambids that have *both*:

1. A moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders a xeric regime; *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 of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

Vitrixerandic Aquicambids

FGAF. Other Aquicambids which 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:

1. 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*

2. A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

Vitrandic Aquicambids

FGAG. Other Aquicambids which have an irregular decrease in organic-carbon content from a depth of 25 cm either to a depth of 125 cm, or to a lithic or paralithic contact if shallower.

Fluventic Aquicambids

FGAH. Other Aquicambids that are dry in all parts of the moisture control section for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders xeric.

Xeric Aquicambids

FGAI. Other Aquicambids that are dry in all parts of the moisture control section for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders an ustic regime.

Ustic Aquicambids

FGAJ. Other Aquicambids.

Typic Aquicambids

Definition of Typic Aquicambids

Typic Aquicambids are the Aquicambids which:

1. Do not have a horizon at least 25 cm thick within 100 cm of the soil surface, that 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;

2. Do not have one or more horizons, within 100 cm of the soil surface, that have a combined thickness of more than 15 cm and that contain 20 percent or more (by volume) durinodes, nodules, or concretions or are brittle and have at least firm rupture resistance class when moist;

3. Have a moisture control section that is dry in all parts for three-fourths of the time (cumulative) or more when the soil temperature is 5°C or higher at a depth of 50 cm or do not have a moisture regime that border an ustic or a xeric regime;

4. Do not have throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the soil surface, *either* 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 of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more;

5. Have a regular decrease in organic-carbon content from a depth of 25 cm either to a depth of 125 cm, or to a lithic or paralithic contact if shallower.

Haplocambids

Haplocambids are the most commonly occurring Cambids in the United States. These soils have minimum horizon expression. Most Haplocambids have a redistribution of carbonates below the cambic horizon. However, the amount of carbonates is insufficient to meet the definition of a calcic horizon or the upper boundary is more than 100 cm below the soil surface. Haplocambids occur on a variety of landscapes, but commonly occur on those younger than late-Pleistocene age.

Definition of Haplocambids

Haplocambids are the Cambids which:

1. Are not both irrigated and have aquic conditions, for some time in most years, in one or more layers within 100 cm of the soil surface; nor are they saturated with water, in one or more layers within 100 cm of the soil surface, for 1 month or more per year in 6 or more out of 10 years;

2. Do not have a duripan or a petrocalcic or petrogypsic horizon that has its upper boundary within 150 cm of the soil surface;

3. Do not have an anthropic epipedon.

Key to subgroups

FGDA. Other Haplocambids that have:

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

2. A moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders a xeric regime.

Lithic Xeric Haplocambids

FGDB. Other Haplocambids that have:

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

2. A moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders an ustic regime.

Lithic Ustic Haplocambids

FGDC. Other Haplocambids that have a lithic contact within 50 cm of the soil surface.

Lithic Haplocambids

FGDD. Other Haplocambids that have:

1. One or both of the following:

   a. Cracks within 125 cm of the 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 soil surface; or

   b. A linear extensibility of 6.0 cm or more between the soil surface and either a depth of 100 cm or to a lithic or paralithic contact, if shallower; and

2. A moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders a xeric regime.

Xerertic Haplocambids

FGDE. Other Haplocambids that have:

1. One or both of the following:

a. Cracks within 125 cm of the 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 soil surface; or

b. A linear extensibility of 6.0 cm or more between the soil surface and either a depth of 100 cm or to a lithic or paralithic contact, if shallower; and

2. A moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders an ustic regime.

Ustertic Haplocambids

FGDF. Other Haplocambids that have at least one of the following:

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

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

Vertic Haplocambids

FGDG. Other Haplocambids which have both of the following:

1. One or more horizons, within 100 cm of the soil surface, that have a combined thickness of 15 cm or more, that contain 20 percent or more (by volume) durinodes or are brittle and have at least a firm rupture resistance class when moist; and

2. A moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature at a depth of 50 cm is 5°C or higher and the moisture regime borders a xeric regime.

Durinodic Xeric Haplocambids

FGDH. Other Haplocambids that have one or more horizons, within 100 cm of the soil surface, that have a combined thickness of 15 cm or more, that contain 20 percent or more (by volume) durinodes or are brittle and have at least a firm rupture resistance class when moist.

Durinodic Haplocambids

FGDI. Other Haplocambids which have one or more horizons, within 100 cm of the soil surface, that have a combined thickness of 15 cm or more, that contain 20 percent or more (by volume) nodules or concretions.

Petronodic Haplocambids

FGDJ. 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

2. A moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature at a depth of 50 cm is 5°C or higher and the moisture regime borders a xeric regime.

Sodic Xeric Haplocambids

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

2. Other Haplocambids that are dry in all parts of the moisture control section for less than three-fourths of the time (cumulative) when the soil temperature at a depth of 50 cm is 5°C or higher and the soil moisture regime borders an ustic regime.

Sodic Ustic Haplocambids

FGDL. Other Haplocambids that have 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.

Sodic Haplocambids

FGDM. Other Haplocambids which have *both*:

1. A moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders a xeric regime; *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 of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

Vitrixerandic Haplocambids

FGDN. Other Haplocambids which 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:

1. 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*

2. A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

Vitrandic Haplocambids

FGDO. Other Haplocambids that:

1. Are dry in all parts of the moisture control section less than three-fourths of the time (cumulative) when the soil temperature at a depth of 50 cm is 5°C or higher and the moisture regime borders a xeric regime; *and*

2. Have an irregular decrease in organic-carbon content from a depth of 25 cm either to a depth of 125 cm, or to a lithic or paralithic contact if shallower.

Xerifluventic Haplocambids

FGDP. Other Haplocambids that:

1. Are dry in all parts of the moisture control section less than three-fourths of the time (cumulative) when the soil temperature at a depth of 50 cm is 5°C or higher and the moisture regime borders an ustic regime; *and*

2. Have an irregular decrease in organic-carbon content from a depth of 25 cm either to a depth of 125 cm, or to a lithic or paralithic contact if shallower.

Ustifluventic Haplocambids

FGDQ. Other Haplocambids which have an irregular decrease in organic-carbon content from a depth of 25 cm either to a depth of 125 cm, or to a lithic or paralithic contact if shallower.

Fluventic Haplocambids

FGDR. Other Haplocambids that are dry in all parts of the moisture control section less than three-fourths of the time (cumulative) when the soil temperature at a depth of 50 cm is 5°C or higher and the moisture regime borders a xeric regime.

Xeric Haplocambids

FGDS. Other Haplocambids that are dry in all parts of the moisture control section less than three-fourths of the time (cumulative) when the soil temperature at a depth of 50 cm is 5°C or higher and the moisture regime borders an ustic regime.

Ustic Haplocambids

FGDT. Other Haplocambids.

Typic Haplocambids

Definition of Typic Haplocambids

Typic Haplocambids are the Haplocambids which:

1. Do not have a lithic contact within 50 cm of the soil surface;

2. Do not have one or more horizons, within 100 cm of the soil surface, that have a combined thickness of more than 15 cm and that contain 20 percent or more (by volume) durinodes, nodules, or concretions or are brittle and have at least firm rupture resistance class when moist;

3. Are dry in all parts of the moisture control section for three-fourths of the time (cumulative) or more when the soil temperature is 5°C or higher at a depth of 50 cm or the moisture regime does not border an ustic or a xeric regime;

4. Have either:

   a. No cracks within 125 cm of the soil surface that are 5 mm or more wide through a thickness of 30 cm or more for some time in most years, and no slickensides, nor wedge-shaped aggregates, in a layer 15 cm or more thick that has its upper boundary within 125 cm of the soil surface; or

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

5. Do not have 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;

6. Have a regular decrease in organic-carbon content from a depth of 25 cm either to a depth of 125 cm, or to a lithic or paralithic contact if shallower;

7. Do not have throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the soil surface, either 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 of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

Petrocambids

These soils have a duripan or a petrocalcic or petrogypsic horizon that has its upper boundary deeper than 100 cm of the soil surface, but within 150 cm of the soil surface. These soils are not extensive because most Aridisols have these diagnostic horizons at shallower depths. However, because of their importance to water movement as well as interpretations, classes for these types of soils are provided.

Definition of Petrocambids

Petrocambids are the Cambids which:

1. Have a duripan or petrocalcic or petrogypsic horizon with an upper boundary within 150 cm of the soil surface;

2. Are not both irrigated and have aquic conditions, for some time in most years, in one or more layers within 100 cm of the soil surface; nor are they saturated with water, in one or more layers within 100 cm of the soil surface, for 1 month or more per year in 6 or more out of 10 years.

Key to subgroups

FGBA. Other Petrocambids that have 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 6 or more years out of 10.

Sodic Petrocambids

FGBB. Other Petrocambids which have *both*:

1. A moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders a xeric regime; *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 of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

Vitrixerandic Petrocambids

FGBC. Other Petrocambids which 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:

1. 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*

2. A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

Vitrandic Petrocambids

FGBD. Other Petrocambids that are dry in all parts of the moisture control section less than three-fourths of the time (cumulative) when the soil temperature at a depth of 50 cm is 5°C or higher and the moisture regime borders a xeric regime.

Xeric Petrocambids

FGBE. Other Petrocambids that are dry in all parts of the moisture control section less than three-fourths of the time (cumulative) when the soil temperature at a depth of 50 cm is 5°C or higher and the moisture regime borders an ustic regime.

Ustic Petrocambids

FGBF. Other Petrocambids

Typic Petrocambids

Definition of Typic Petrocambids

Typic Petrocambids are the Petrocambids which:

1. Do not have a horizon of 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;

2. Are dry in all parts of the moisture control section three-fourths of the time (cumulative) or more when the soil temperature at a depth of 50 cm is 5°C or higher or the moisture regime does not border an ustic or a xeric regime;

3. Do not have throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the soil surface, either 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 of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

Cryids

Cryids are the Aridisols of cold areas. Short growing seasons combined with arid conditions limit the use of these soils. They are characteristically at high elevations, dominantly in the mountain and basin areas in the United States as well as other parts of the world.

Cryids may have a duripan or an argillic, calcic, cambic, gypsic, natric, petrocalcic, petrogypsic, or salic horizon. These horizons are the basis for great groups. Haplocryids have minimal development. Some Cryids occur near ustic or xeric soil moisture regimes and these features are the basis for subgroups.

Definition

Cryids are the Aridisols that have a cryic temperature regime.

Key to great groups

FAA. Cryids which have a salic horizon that has its upper boundary within 100 cm of the soil surface.

Salicryids

FAB. Other Cryids which have a duripan, or a petrocalcic or petrogypsic horizon that has its upper boundary within 100 cm of the soil surface.

Petrocryids

FAC. Other Cryids which have a gypsic horizon that has its upper boundary within 100 cm of the soil surface.

Gypsicryids

FAD. Other Cryids that have an argillic or a natric horizon.

Argicryids

FAE. Other Cryids which have a calcic horizon that has its upper boundary within 100 cm of the soil surface.

Calcicryids

FAF. Other Cryids.

Haplocryids

Argicryids

These are the Cryids that have an illuvial horizon in which silicate clays have accumulated. In general the Argicryids without natric horizons formed on late-Pleistocene or older sediments or surfaces. Many of these soils receive increments of dust, which may be a source of clay-sized particles. The Argicryids may be on gentle or steep slopes. These soils are not extensive.

Definition

Argicryids are the Cryids which:

1. Have an argillic or natric horizon;

2. Do not have a duripan or a gypsic, petrocalcic, petrogypsic, or salic horizon with an upper boundary within 100 cm of the soil surface.

Key to subgroups

FADA. Argicryids that have a lithic contact within 50 cm of the soil surface.

Lithic Argicryids

FADB. Other Argicryids that have:

1. Cracks within 125 cm of the soil surface that are 5 mm or more wide throughout 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 cm or more between the mineral soil surface and either a depth of 100 cm or a lithic or paralithic contact, whichever is shallower.

Vertic Argicryids

FADC. Other Argicryids which have a natric horizon that has its upper boundary within 100 cm of the soil surface.

Natric Argicryids

FADD. Other Argicryids which have *both*:

1. A moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders a xeric regime; *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 of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

Vitrixerandic Argicryids

FADE. Other Argicryids which 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:

1. 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*

2. A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter of which

5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

Vitrandic Argicryids

FADF. Other Argicryids that are dry in all parts of the moisture control section less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders a xeric regime.

Xeric Argicryids

FADG. Other Argicryids that are dry in all parts of the moisture control section less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders an ustic regime.

Ustic Argicryids

FADH. Other Argicryids.

Typic Argicryids

Definition of Typic Argicryids

Typic Argicryids are the Argicryids which:

1. Do not have a lithic contact within 50 cm of the soil surface;

2. Have either:

a. No cracks within 125 cm of the soil surface that are 5 mm or more wide through a thickness of 30 cm or more for some time in most years, and no slickensides, nor wedge-shaped aggregates, in a layer 15 cm or more thick that has its upper boundary within 125 cm of the soil surface; or

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

3. Do not have a natric horizon that has its upper boundary within 100 cm of the soil surface;

4. Are dry in all parts of the moisture control section three-fourths of the time (cumulative) or more when the soil temperature is 5°C at a depth of 50 cm or the moisture regime does not border an ustic or a xeric regime;

5. Do not have throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the soil surface, either 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 of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

Calcicryids

These are the Cryids that are derived from high lime parent materials or have had lime added as dust. Precipitation is unable to remove the calcium carbonate to substantial depths. These soils typically have an ochric epipedon and a calcic horizon. Some have a cambic horizon overlying the calcic horizon.

Definition

Calcicryids are the Cryids which:

1. Have a calcic horizon that has its upper boundary within 100 cm of the soil surface;

2. Do not have a duripan or a gypsic, petrocalcic, petrogypsic, or salic horizon with an upper boundary within 100 cm of the soil surface;

3. Do not have an argillic or a natric horizon.

Key to subgroups

FAEA. Calcicryids that have a lithic contact within 50 cm of the soil surface.

Lithic Calcicryids

FAEB. Other Calcicryids which have *both*:

1. A moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders a xeric regime; *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 of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

Vitrixerandic Calcicryids

FAEC. Other Calcicryids which 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:

1. 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*

2. A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

Vitrandic Calcicryids

FAED. Other Calcicryids that are dry in all parts of the moisture control section for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders a xeric regime.

Xeric Calcicryids

FAEE. Other Calcicryids that are dry in all parts of the moisture control section for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders an ustic regime.

Ustic Calcicryids

FAEF. Other Calcicryids.

Typic Calcicryids

Definition of Typic Calcicryids

Typic Calcicryids are the Calcicryids which:

1. Do not have a lithic contact within 50 cm of the soil surface;

2. Are dry in all parts of the moisture control section for three-fourths of the time (cumulative) or more when the soil temperature is 5°C or higher at a depth of 50 cm or do not have a moisture regime that borders an ustic or a xeric regime;

3. Do not have throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the soil surface, either 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 of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

Gypsicryids

Gypsicryids are the Cryids that have a gypsic horizon. These soils formed in parent materials rich in gypsum. The Gypsicryids are rare.

Definition

Gypsicryids are the Cryids which:

1. Have a gypsic horizon that has its upper boundary within 100 cm of the soil surface;

2. Do not have a duripan or petrocalcic, petrogypsic, or salic horizon with an upper boundary within 100 cm of the soil surface.

Key to Subgroups

FACA. Gypsicryids that have a calcic horizon.
Calcic Gypsicryids

FACB. Other Gypsicryids which have *both*:

1. A moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders a xeric regime; *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 of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.
Vitrixerandic Gypsicryids

FACC. Other Gypsicryids which 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:

1. 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*

2. A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.
Vitrandic Gypsicryids

FACD. Other Gypsicryids.
Typic Gypsicryids

Definition of Typic Gypsicryids

Typic Gypsicryids are the Gypsicryids which:

1. Do not have a calcic horizon;

2. Do not have throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the soil surface, either 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 of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

Haplocryids

These are the Cryids that have a cambic horizon. An ochric epipedon is often present. Other diagnostic horizons may occur below 100 cm. These soils often have an accumulations of calcium carbonate below the cambic horizon. Haplocryids are rare.

Definition

Haplocryids are the Cryids which:

1. Do not have an argillic or natric horizon;

2. Do not have a duripan or a calcic, gypsic, petrocalcic, petrogypsic, or salic horizon that has an upper boundary within 100 cm of the soil surface.

Key to subgroups

FAFA. Haplocryids that have a lithic contact within 50 cm of the soil surface.
Lithic Haplocryids

FAFB. Other Haplocryids that have either:

1. Cracks within 125 cm of the soil surface that are 5 mm or more wide throughout 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 cm or more between the mineral soil surface and either a depth of 100 cm or a lithic or paralithic contact, whichever is shallower.
Vertic Haplocryids

FABC. Other Haplocryids that have *both*:

1. A moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders a xeric regime; *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 of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.
Vitrixerandic Haplocryids

FAFD. Other Haplocambids which 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:

1. 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*

2. A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

Vitrandic Haplocryids

FAFE. Other Haplocryids that are dry in all parts of the moisture control section for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders a xeric regime.

Xeric Haplocryids

FAFF. Other Haplocryids that are dry in all parts of the moisture control section for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders an ustic regime.

Ustic Haplocryids

FAFG. Other Haplocryids.

Typic Haplocryids

Definition of Typic Haplocryids

Typic Haplocryids are the Haplocryids which:

1. Do not have a lithic contact within 50 cm of the soil surface;

2. Have either:

a. No cracks within 125 cm of the soil surface that are 5 mm or more wide through a thickness of 30 cm or more for some time in most years, and no slickensides, nor wedge-shaped aggregates, in a layer 15 cm or more thick that has its upper boundary within 125 cm of the soil surface; or

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

3. Are dry in all parts of the moisture control section for three-fourths of the time (cumulative) or more when the soil temperature is 5°C at a depth of 50 cm or do not have a moisture regime that borders an ustic or a xeric regime;

4. Do not have throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the soil surface, either 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 of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

Petrocryids

These are the Cryids that have a duripan, petrocalcic, or petrogypsic horizon. An argillic or natric horizon may be present above the cemented layer. These soils occur in the mountains of Idaho and possibly Wyoming.

Definition

Petrocryids are the Cryids which:

1. Have a duripan, petrocalcic, or petrogypsic horizon with an upper boundary within 100 cm of the soil surface;

2. Do not have a salic horizon that has its upper boundary within 100 cm of the soil surface.

Key to subgroups

FABA. Petrocryids that have:

1. A duripan that has its upper boundary within 100 cm of the soil surface; and

2. Are dry in all parts of the moisture control section for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the soil moisture regime borders a xeric regime.

Duric Xeric Petrocryids

FABB. Other Petrocryids which have a duripan that has its upper boundary within 100 cm of the soil surface.

Duric Petrocryids

FABC. Other Petrocryids which have a petrogypsic horizon that has its upper boundary within 100 cm of the soil surface.

Petrogypsic Petrocryids

FABD. Other Petrocryids that are dry in all parts of the moisture control section for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the soil moisture regime borders xeric.

Xeric Petrocryids

FABE. Other Petrocryids that are dry in all parts of the moisture control section for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the soil moisture regime borders ustic.

Ustic Petrocryids

FABF. Other Petrocryids.

Typic Petrocryids

Definition of Typic Petrocryids

Typic Petrocryids are the Petrocryids which:

1. Have a petrocalcic horizon that has its upper boundary within 100 cm of the soil surface;

2. Do not have a duripan or a petrogypsic horizon that has an upper boundary within 100 cm of the soil surface;

3. Are dry in all parts of the moisture control section three-fourths of the time (cumulative) or more when the soil temperature is 5°C at a depth of 50 cm or do not have a moisture regime that borders an ustic or a xeric regime.

Salicryids

Salicryids are the Cryids that have a salic horizon. These soils occur in extremely arid, cold regions of the world.

Definition

Salicryids are the Cryids which have a salic horizon that has its upper boundary within 100 cm of the soil surface.

Key to subgroups

FAAA. Salicryids that are saturated with water in one or more layers within 100 cm of the soil surface for 1 month or more per year in 6 or more out of 10 years.

Aquic Salicryids

FAAB. Other Salicryids.

Typic Salicryids

Definition of Typic Salicryids

Typic Salicryids are the Salicryids that are not saturated with water in any layer within 100 cm of the soil surface for 1 month or more per year in 6 or more out of 10 years.

Durids

Durids are the Aridisols which have a duripan that has an upper boundary within 100 cm of the soil surface. Many duripans are within 50 cm of the soil surface. These soils occur dominantly on gentle slopes and formed from sediments that contain pyroclastics. The duripan is cemented partly with opal or chalcedony. Calcium carbonate is commonly present also.

Some Durids have argillic or natric horizons above the duripan and these horizons are the basis for recognizing great groups. Where these soils occur in areas adjacent to an ustic or xeric moisture regime, intergrades are recognized at the subgroup level. Most of these soils are used for grazing. The amount of forage is low where the duripan is shallow.

These occur in the western United States, particularly in Nevada.

Definition

Durids are the Aridisols which:

1. Have a duripan that has its upper boundary within 100 cm of the surface;

2. Have a soil temperature regime warmer than cryic;

3. Do not have a salic horizon that has its upper boundary within 100 cm of the soil surface.

Key to great groups

FCA. Durids that have a natric horizon above the duripan.

Natridurids

FCB. Other Durids that have an argillic horizon above the duripan.

Argidurids

FCC. Other Durids.

Haplodurids

Argidurids

These are the Durids with an argillic horizon above the duripan. Commonly the duripan is within 50 cm of the soil surface. These soils are close to volcanic areas or formed in eolian or alluvial sediments derived from pyroclastics.

Definition

Argidurids are the Durids which:

1. Have an argillic horizon above the duripan;

2. Do not have a natric horizon above the duripan.

Key to subgroups

FCBA. Argidurids which have, above the duripan, one or both of the following:

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

2. A linear extensibility of 6.0 cm or more between the soil surface and the top of the duripan.

Vertic Argidurids

FCBB. Other Argidurids that are either:

1. Irrigated and have aquic conditions, for some time in most years, in one or more layers within 100 cm of the soil surface; *or*

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

Aquic Argidurids

FCBC. Other Argidurids that have the following combination of characteristics:

1. An argillic horizon that has 35 percent or more clay in the fine-earth fraction of some part and also has either;

   a. A clay increase of 15 percent or more clay (absolute) within a vertical distance of 2.5 cm either within the argillic horizon or at its upper boundary; or

   b. If there is an Ap horizon directly above the argillic horizon, a clay increase of 10 percent or more (absolute) at the upper boundary of the argillic horizon; and

2. A moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders a xeric regime.

Abruptic Xeric Argidurids

FCBD. Other Argidurids which have an argillic horizon that has 35 percent or more clay in the fine-earth fraction of some part, and either;

1. A clay increase of 15 percent or more clay (absolute) within a vertical distance of 2.5 cm within the argillic or at its upper boundary; or

2. If there is an Ap horizon directly above the argillic horizon, a clay increase of 10 percent or more (absolute) at the upper boundary of the argillic horizon.

Abruptic Argidurids

FCBE. Other Argidurids which have:

1. A duripan that is strongly cemented or less cemented in all subhorizons; and

2. A moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders a xeric regime.

Haploxeralfic Argidurids

FCBF. Other Argidurids which have a duripan that is strongly cemented or less cemented in all subhorizons.

Argidic Argidurids

FABG. Other Argidurids that have *both*:

1. A moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders a xeric regime; *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 of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

Vitrixerandic Argidurids

FABH. Other Argidurids which 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:

1. 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*

2. A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

Vitrandic Argidurids

FCBI. A moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders a xeric regime.

Xeric Argidurids

FCBJ. Other Argidurids which have a moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature at a depth of 50 cm from the soil surface is 5°C or higher and a moisture regime that borders on an ustic regime.

Ustic Argidurids

FCBK. Other Argidurids.

Typic Argidurids

Definition of Typic Argidurids

Typic Argidurids are the Argidurids which:

1. Do not have either of the following:

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

b. A linear extensibility of 6.0 cm or more between the soil surface and the top of the duripan;

2. Are not both irrigated and have aquic conditions, for some time in most years, in one or more layers within 100 cm of the soil surface; nor are they saturated with water, in one or more layers within 100 cm of the soil surface, for 1 month or more per year in 6 or more out of 10 years;

3. Have an argillic horizon that has less than 35 percent clay in the fine-earth fraction of some part or;

a. A clay increase of less than 15 percent clay (absolute) within a vertical distance of 2.5 cm both within the argillic horizon and at its upper boundary; or

b. If there is an Ap horizon directly above the argillic horizon, a clay increase of less than 10 percent (absolute) at the upper boundary of the argillic horizon;

4. A moisture control section that is dry in all parts for three-fourths of the time (cumulative) or more when the soil temperature at a depth of 50 cm from the soil surface is 5°C or higher or the moisture regime does not border on a xeric or an ustic regime;

5. Do not have throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the soil surface, either 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 of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more;

6. Have a duripan that is strongly cemented or less cemented in all subhorizons.

Haplodurids

These are the Durids which do not have a natric or argillic horizon. These soils formed in materials that have a pyroclastic influence. Most Haplodurids are used for grazing.

Definition

Haplodurids are the Durids that do not have an argillic or natric horizon above the duripan.

Key to subgroups

FCCA. Haplodurids that:

1. Have a duripan that is strongly cemented or less cemented in all subhorizons; and

2. Are either:

a. Irrigated and have aquic conditions, for some time in most years, in one or more layers within 100 cm of the soil surface; *or*

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

Aquicambidic Haplodurids

FCCB. Other Haplodurids that are either:

1. Irrigated and have aquic conditions, for some time in most years, in one or more layers within 100 cm of the soil surface; *or*

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

Aquic Haplodurids

FCCC. Other Haplodurids that have:

1. A duripan that is strongly cemented or less cemented in all subhorizons; and

2. A mean annual soil temperature lower than 22° C, a difference of 5°C or more between mean summer and mean winter soil temperatures at a depth of 50 cm from the soil surface, and a moisture regime that borders on a xeric regime.

Xerochreptic Haplodurids

FCCD. Other Haplodurids that have a duripan that is strongly cemented or less cemented in all subhorizons.

Cambidic Haplodurids

FCCE. Other Haplodurids that have:

1. A moisture control section that is dry in all parts for three-fourths of the time (cumulative) or less when the soil temperature at a depth of 50 cm is 5°C or higher and a moisture regime that borders on a xeric regime; *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 of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

Vitrixerandic Haplodurids

FCCF. Other Haplodurids 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:

1. 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*

2. A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

Vitrandic Haplodurids

FCCG. A mean annual soil temperature lower than 22°C, a difference of 5°C or more between mean summer and mean winter soil temperatures at a depth of 50 cm from the soil surface, and a moisture regime that borders on a xeric regime.

Xeric Haplodurids

FCCH. A moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature at a depth of 50 cm is 5°C or higher and a moisture regime that borders on an ustic regime.

Ustic Haplodurids

FCCI. Other Haplodurids.

Typic Haplodurids

Definition of Typic Haplodurids

Typic Haplodurids are the Durids which:

1. Are not both irrigated and have aquic conditions, for some time in most years, in one or more layers within 100 cm of the soil surface nor are they saturated with water, in one or more layers within 100 cm of the soil surface, for 1 month or more per year in 6 or more out of 10 years;

2. Have a moisture control section that is dry in all parts for three-fourths of the time (cumulative) or more when the soil temperature at a depth of 50 cm is 5°C or higher or a moisture regime that does not border on an ustic or a xeric regime;

3. Do not have throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the soil surface, either 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 of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more;

4. Have a duripan that is indurated or very strongly cemented in at least one subhorizon.

Natridurids

These are the Durids that have a natric horizon above the duripan. Commonly, the duripan is within 50 cm of the soil surface. In many places the duripan is also plugged by calcium carbonate. The soils are commonly on gently sloping landscapes and formed in materials derived from pyroclastics. They are not extensive and most are used for grazing.

Definition

Natridurids are the Durids that have a natric horizon above the duripan.

Key to subgroups

FCAA. Natridurids which have, above the duripan, one or both of the following:

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

2. A linear extensibility of 6.0 cm or more between the soil surface and the top of the duripan.

Vertic Natridurids

FCAB. Other Natridurids which have both:

1. A duripan that is strongly cemented or less cemented in all subhorizons; and

2. Either:

a. Irrigated and have aquic conditions, for some time in most years, in one or more layers within 100 cm of the soil surface; *or*

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

Aquic Natrargidic Natridurids

FCAC. Other Natridurids that are either:

1. Irrigated and have aquic conditions, for some time in most years, in one or more layers within 100 cm of the soil surface; *or*

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

Aquic Natridurids

FCAD. Other Natridurids that have the following combination of characteristics:

1. Have a duripan that is strongly cemented or less cemented in all subhorizons; and

2. A moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders a xeric regime.

Natraxeralfic Natridurids

FCAE. Other Natridurids that have a duripan that is strongly cemented or less cemented in all subhorizons.

Natrargidic Natridurids

FCAF. Other Natridurids that have *both*:

1. A moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders a xeric regime; *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 of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

Vitrixerandic Natridurids

FCAG. Other Natridurids which 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:

1. 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*

2. A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

Vitrandic Natridurids

FCAH. Other Natridurids that have a moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders a xeric regime.

Xeric Natridurids

FCAI. Other Natridurids.

Typic Natridurids

Definition of Typic Natridurids

Typic Natridurids are the Durids which:

1. Do not have either of the following:

a. Cracks between the soil surface and the top of the duripan that are 5 mm or more wide through a thickness of 30 cm or more for some time in most years, slickensides, or wedge-shaped aggregates, in a layer 15 cm or more thick that has its upper boundary above the duripan; nor

b. A linear extensibility of 6.0 cm or more between the soil surface and the top of the duripan;

2. Are not both irrigated and have aquic conditions, for some time in most years, in one or more layers within 100 cm of the soil surface; nor are they saturated with water, in one or more layers within 100 cm of the soil surface, for 1 month or more per year in 6 or more out of 10 years;

3. Have a moisture control section that is dry in all parts for than three-fourths of the time (cumulative) or more when the soil temperature is 5°C or higher at a depth of 50 cm or the moisture regime does not border on an ustic or a xeric regime;

4. Have a duripan that is either indurated or very strongly cemented in at least one subhorizon;

5. Do not have throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the soil surface, either 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 of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

Gypsids

Gypsids are the Aridisols that have a gypsic or petrogypsic horizon within 100 cm of the soil surface. Accumulation of gypsum takes place initially as crystal aggregates in the voids of the soil. These aggregates grow by accretion, displacing the enclosing soil material. When the gypsic horizon is present as a cemented impermeable layer, it is recognized as the petrogypsic horizon. Each of these forms of gypsum accumulation infers processes in the soils and each presents a constraint to soil use.

The presence of one or more of these horizons, with or without other diagnostic horizons, define the great groups in the Gypsids. The Petrogypsids have a petrogypsic horizon within 100 cm of the soil surface. When they are close to the surface, crusting forms pseudo-hexagonal patterns on the soil surface. Petrogypsids occupy old surfaces. In Syria and Iraq, they are present on the highest terraces of the Tigris and Euphrates Rivers.

The Haplogypsids are present on many segments of the landscape. Some of them have a calcic or related horizons which overlie the gypsic horizon.

Definition

Gypsids are the Aridisols which:

1. Have a gypsic or petrogypsic horizon that has an upper boundary within 100 cm of the soil surface;

2. Do not have a petrocalcic horizon overlying the gypsic or petrogypsic horizon;

3. Have a soil temperature regime warmer than cryic;

4. Do not have a duripan or salic horizon that has an upper boundary within 100 cm of the soil surface.

Key to great groups

FDA. Gypsids that have a petrogypsic or petrocalcic horizon that has its upper boundary within 100 cm of the soil surface.

Petrogypsids

FDB. Other Gypsids that have a natric horizon that has its upper boundary within 100 cm of the soil surface.

Natrigypsids

FDC. Other Gypsids that have an argillic horizon that has its upper boundary within 100 cm of the soil surface.

Argigypsids

FDD. Other Gypsids that have a calcic horizon that has its upper boundary within 100 cm of the soil surface.

Calcigypsids

FDE. Other Gypsids.

Haplogypsids

Argigypsids

Argigypsids are the Gypsids that have an argillic horizon. These soils are known to occur in the Four Corners area of the western United States. They are used primarily for grazing.

Definition

Argigypsids are the Gypsids which:

1. Have an argillic horizon that has its upper boundary within 100 cm of the soil surface;

2. Do not have a natric or petrogypsic horizon with an upper boundary within 100 cm of the soil surface.

Key to subgroups

FDCA. Argigypsids that have a lithic contact within 50 cm of the soil surface.

Lithic Argigypsids

FDCB. Other Argigypsids which have:

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

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

Vertic Argigypsids

FDCC. Other Argigypsids that have a calcic horizon overlying the gypsic horizon.

Calcic Argigypsids

FDCD. Other Argigypsids which have one or more horizons, within 100 cm of the soil surface, that have a combined thickness of 15 cm or more, that contain 20 percent or more (by volume) durinodes, nodules, or concretions.

Petronodic Argigypsids

FDCE. Other Argigypsids which have *both*:

1. A moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders a xeric regime; *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 of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

Vitrixerandic Argigypsids

FDCF. Other Argigypsids which 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:

1. 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*

2. A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 percent or more.

Vitrandic Argigypsids

FDCG. Other Argigypsids that have a moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature at a depth of 50 cm is 5°C or higher and a moisture regime that borders a xeric regime.

Xeric Argigypsids

FDCH. Other Argigypsids that have a moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature at a depth of 50 cm is 5°C or higher and a moisture regime that borders an ustic regime.

Ustic Argigypsids

FDCI. Other Argigypsids.

Typic Argigypsids

Definition of Typic Argigypsids

Typic Argigypsids are the Argigypsids which:

1. Do not have a lithic contact within 50 cm of the soil surface;

2. Have either:

a. No cracks within 125 cm of the soil surface that are 5 mm or more wide through a thickness of 30 cm or more for some time in most years, and no slickensides, nor wedge-shaped aggregates, in a layer 15 cm or more thick that has its upper boundary within 125 cm of the soil surface; or

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

3. Do not have a calcic horizon overlying the gypsic horizon;

4. Have a moisture control section that is dry in all parts for three-fourths of the time (cumulative) or more when the soil temperature at a depth of 50 cm is 5°C or higher or do not have a moisture regime that borders an ustic or a xeric moisture regime;

5. Do not have one or more horizons, within 100 cm of the soil surface, that have a combined thickness of more than 15 cm and that contain 20 percent or more (by volume) durinodes, nodules, or concretions or are brittle and have at least firm rupture resistance class when moist;

6. Do not have throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the soil surface, either 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 of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

Calcigypsids

Calcigypsids are the Gypsids that have a calcic horizon. Commonly the calcic horizon is above the gypsic horizon because of the differences in solubilities of gypsum and calcium carbonate. These soils are known to occur in New Mexico. Most Calcigypsids are used for grazing.

Definition of Calcigypsids

Calcigypsids are the Gypsids which:

1. Have both a gypsic and calcic horizon that have their upper boundary within 100 cm of the soil surface;

2. Do not have an argillic, natric, petrogypsic, or petrocalcic horizon that has an upper boundary within 100 cm of the soil surface.

Key to subgroups

FDDA. Calcigypsids that have a lithic contact within 100 cm of the soil surface.

Lithic Calcigypsids

FDDB. Other Calcigypsids which have one or more horizons, within 100 cm of the soil surface, that have a combined thickness of 15 cm or more, that contain 20 percent or more (by volume) durinodes, nodules, or concretions.

Petronodic Calcigypsids

FDDC. Other Calcigypsids which have *both*:

1. A moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders a xeric regime; *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 of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

Vitrixerandic Calcigypsids

FDDD. Other Calcigypsids which 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:

1. 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*

2. A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

Vitrandic Calcigypsids

FDDE. Other Calcigypsids that have a moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature at a depth of 50 cm is 5°C or higher and have a moisture regime that borders on a xeric regime.

Xeric Calcigypsids

FDDF. Other Calcigypsids that have a moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature at a depth of 50 cm is 5°C or higher and have a moisture regime that borders on an ustic regime.

Ustic Calcigypsids

FDDG. Other Calcigypsids.

Typic Calcigypsids

Definition of Typic Calcigypsids

Typic Calcigypsids are the Calcigypsids which:

1. Have a moisture control section that is dry in all parts for three-fourths of the time (cumulative) or more when the soil temperature at a depth of 50 cm is 5°C or higher or the moisture regime does not border an ustic or xeric regime;

2. Do not have a lithic contact within 100 cm of the soil surface;

3. Do not have one or more horizons, within 100 cm of the soil surface, that have a combined thickness of more than 15 cm and that contain 20 percent or more (by volume) durinodes, nodules, or concretions or are brittle and have at least firm rupture resistance class when moist;

4. Do not have throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the soil surface, either 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 of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

Haplogypsids

Haplogypsids are the Gypsids that have no petrogypsic, natric, argillic, or calcic horizon that has an upper boundary within 100 cm of the soil surface. Some have a cambic horizon overlying the gypsic horizon. These soils are commonly very pale in color. They are not extensive in the United Stated, but the largest concentrations are in New Mexico and Texas. In other parts of the world Haplogypsids are more common.

Definition of Haplogypsids

These are the Gypsids which:

1. Do not have a petrogypsic or calcic horizon that has an upper boundary within 100 cm of the soil surface;

2. Do not have an argillic or natric horizon that has an upper boundary within 100 cm of the soil surface.

Key to subgroups

FDEA. Haplogypsids that have a lithic contact within 50 cm of the soil surface.

Lithic Haplogypsids

FDEB. Other Haplogypsids which have a gypsic horizon that has its upper boundary within 18 cm of the soil surface.

Leptic Haplogypsids

FDEC. Other Haplogypsids which have in one or more horizons, within 100 cm of the soil surface, an exchangeable sodium percentage of 15 or more (or a sodium adsorption ratio of 13 or more) for 6 or more months per year in 6 or more out of 10 years.

Sodic Haplogypsids

FDED. Other Haplogypsids which have one or more horizons, within 100 cm of the soil surface, that have a combined thickness of 15 cm or more, that contain 20 percent or more (by volume) durinodes, nodules, or concretions.

Petronodic Haplogypsids

FDEE. Other Haplogypsids which have *both*:

1. A moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders a xeric regime; *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 of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

Vitrixerandic Haplogypsids

FDEF. Other Haplogypsids which 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:

1. 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*

2. A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

Vitrandic Haplogypsids

FDEG. Other Haplogypsids that have a moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature at a depth of 50 cm is 5°C or higher and have a moisture regime that borders on a xeric regime.

Xeric Haplogypsids

FDEH. Other Haplogypsids that have a moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature at a depth of 50 cm is 5°C or higher and have a moisture regime that borders on an ustic regime.

Ustic Haplogypsids

FCEI. Other Haplogypsids.

Typic Haplogypsids

Definition of Typic Haplogypsids

Typic Haplogypsids are the Haplogypsids which:

1. Do not have a lithic contact within 50 cm of the soil surface;

2. Do not have a gypsic horizon that has its upper boundary within 18 cm of the soil surface;

3. Do not have in one or more horizons, within 100 cm of the soil surface, an exchangeable sodium percentage of 15 or more (or a sodium adsorption ratio of 13 or more) for 6 or more months per year in 6 or more out of 10 years;

4. Have a moisture control section that is dry in all its parts for three-fourths of the time (cumulative) when the soil temperature at a depth of 50 cm is 5°C or higher or the moisture regime does not border an ustic or a xeric regime;

5. Do not have one or more horizons, within 100 cm of the soil surface, that have a combined thickness of more than 15 cm and that contain 20 percent or more (by volume) durinodes, nodules, or concretions or are brittle and have at least firm rupture resistance class when moist;

6. Do not have throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the soil surface, either 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 of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

Natrigypsids

Natrigypsids are the Gypsids that have a natric horizon and no petrogypsic or petrocalcic horizon within 100 cm of the soil surface. The gypsic horizon is commonly below the natric horizon. These soils formed in parent materials high in gypsum and sodium such as sedimentary materials that were deposited in a marine environment. These soils are rare, but are known to occur in the Four Corners area of the western United States. The Natrigypsids are used primarily for grazing.

Key to subgroups

FDBA. Natrigypsids that have a lithic contact within 50 cm of the soil surface.

Lithic Natrigypsids

FDBB. Other Natrigypsids that have:

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

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

Vertic Natrigypsids

FDBC. Other Natrigypsids which have one or more horizons, within 100 cm of the soil surface, that have a combined thickness of 15 cm or more, that contain 20 percent or more (by volume) durinodes, nodules, or concretions.

Petronodic Natrigypsids

FDBD. Other Natrigypsids which have *both*:

1. A moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders a xeric regime; *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 of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

Vitrixerandic Natrigypsids

FDBE. Other Natrigypsids which 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:

1. 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*

2. A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

Vitrandic Natrigypsids

FDBF. Other Natrigypsids that have a moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature at a depth of 50 cm is 5°C or higher and have a moisture regime that borders a xeric regime.

Xeric Natrigypsids

FDBG. Other Natrigypsids that have a moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature at a depth of 50 cm is 5°C or higher and have a moisture regime that borders an ustic regime.

Ustic Natrigypsids

FDBH. Other Natrigypsids.

Typic Natrigypsids

Definition of Typic Natrigypsids

Typic Natrigypsids are the Natrigypsids which:

1. Do not have a lithic contact within 50 cm of the soil surface;

2. Have either:

   a. No cracks within 125 cm of the soil surface that are 5 mm or more wide through a thickness of 30 cm or more for some time in most years, and no slickensides, nor wedge-shaped aggregates, in a layer 15 cm or more thick that has its upper boundary within 125 cm of the soil surface; or

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

3. Have a moisture control section that is dry in all parts for three-fourths of the time (cumulative) or more when the soil temperature at a depth of 50 cm is 5°C or higher or the moisture regime does not border an ustic or xeric regime;

4. Do not have throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the soil surface, either 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 of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more;

5. Do not have one or more horizons, within 100 cm of the soil surface, that have a combined thickness of more than 15 cm and that contain 20 percent or more (by volume) durinodes, nodules, or concretions or are brittle and have at least firm rupture resistance class when moist.

Petrogypsids

Petrogypsids are the Gypsids that have a petrogypsic or petrocalcic horizon that has its upper boundary within 100 cm of the soil surface. These soils occur in very arid areas of the world where the parent material is high in gypsum. These soils are not extensive in the United States, but are in other countries.

Definition

Petrogypsids are the Gypsids that have a petrogypsic or petrocalcic horizon that has its upper boundary within 100 cm of the soil surface.

Key to subgroups

FDAA. Other Petrogypsids which have a petrocalcic horizon that has its upper boundary within 100 cm of the soil surface.

Petrocalcic Petrogypsids

FDAB. Other Petrogypsids which have a calcic horizon overlying the petrogypsic horizon.

Calcic Petrogypsids

FDAC. Other Petrogypsids which have *both*:

1. A moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature is 5°C or higher at a depth of 50 cm and the moisture regime borders a xeric regime; *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 of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

Vitrixerandic Petrogypsids

FDAD. Other Petrogypsids which 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:

1. 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*

2. A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

Vitrandic Petrogypsids

FDAE. Other Petrogypsids that have a moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature at a depth of 50 cm is 5°C or higher and have a moisture regime that borders a xeric regime.

Xeric Petrogypsids

FDAF. Other Petrogypsids that have a moisture control section that is dry in all parts for less than three-fourths of the time (cumulative) when the soil temperature at a depth of 50 cm is 5°C or higher and have a moisture regime that borders an ustic regime.

Ustic Petrogypsids

FDAG. Other Petrogypsids.

Typic Petrogypsids

Definition of Typic Petrogypsids

Typic Petrogypsids are the Petrogypsids which:

1. Do not have a petrocalcic horizon within 100 cm of the soil surface;

2. Do not have a calcic horizon overlying the petrogypsic horizon;

3. Have a moisture control section that is dry in all parts for three-fourths of the time (cumulative) or more when the soil temperature at a depth of 50 cm is 5°C or higher or the moisture regime does not border an ustic or a xeric regime;

4. Do not have throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the soil surface, either 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 of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

Salids

Salids are most common in depressions (playas) in the deserts or in closed basins in the wetter areas bordering the deserts. In North Africa and in the Near East, such depressions are referred to as Sebkhas or Chotts, depending on the presence or absence of surface water for prolonged periods.

Under the arid environment and hot temperatures, accumulation of salts commonly occurs when there is a supply of salts and a net upward movement of water in the soil. In some areas salic horizons have formed in salty parent materials without the presence of ground water. The most common form of salt is sodium chloride (halite) but sulfates (thernadite, mirabilite, hexahydrite) and other salts may also be present. Accumulation of silica to form duripans may also take place in such environments if the ground water is sufficiently alkaline.

The concept of Salids is one of accumulation of an excessive amount of salts which are more soluble than gypsum. This is implicit in the definition which requires a minimum absolute EC of 30 dS/m in 1:1 extract (about 2% salt) and a product of EC and thickness of at least 900. Salids are as a rule unsuitable for agricultural use unless the salts are leached out. The latter is an expensive undertaking particularly if there is no natural outlet for the drainage water.

Two great groups are recognized: Aquisalids which are saturated with water for one month or more during the year and Haplosalids which are drier.

Definition

Salids are the Aridisols that have:

1. A salic horizon that has its upper boundary within 100 cm of the soil surface;

2. A soil temperature regime warmer than cryic.

Salids

Key to great groups

FBA. Salids that are saturated with water in one or more layers within 100 cm of the mineral soil surface for one month or more per year in 6 or more out of 10 years.

Aquisalids

FBB. Other Salids.

Haplosalids

Aquisalids

These are the salty soils of wet places in the deserts where capillary rise and evaporation of water concentrate the salts near the surface. Some of these soils have redoximorphic depletions and concentrations. In other soils redoximorphic features may not be present due to the high pH and associated low electrode potential which inhibit iron and manganese reduction. These soils occur dominantly in depressional areas where ground water saturates the soil at least part of the year. Vegetation on these soils is usually sparse, consisting of salt-tolerant shrubs, grasses, and forbs. Although these soils may have water held at a tension greater than 1500 kPa, the dissolved salt content makes these soils physiologically dry.

Definition

Aquisalids are the Salids that are saturated with water in one or more layers within 100 cm of the mineral soil surface for one month or more per year in 6 or more out of 10 years.

Key to subgroups

FBAA. Aquisalids which have a gypsic or petrogypsic horizon that has its upper boundary within 100 cm of the soil surface.

Gypsic Aquisalids

FBAB. Other Aquisalids which have a calcic or petrocalcic horizon that has an upper boundary within 100 cm of the soil surface.

Calcic Aquisalids

FBAC. Other Aquisalids.

Typic Aquisalids

Definition of Typic Aquisalids

Typic Aquisalids are the Aquisalids which do not have a calcic, gypsic, petrocalcic, or petrogypsic horizon that has its upper boundary within 100 cm of the soil surface.

Haplosalids

These are the Salids that have a high concentration of salts, but do not have the saturation that is associated with the Aquisalids. These soils may be saturated for shorter periods of time than the Aquisalids, or may have had a water table associated with a past climate. In the Four Corners area of the United States salic horizons have formed without the influence of a water table in saline parent materials.

Definition

Haplosalids are the Salids that are not saturated with water in one or more layers within 100 cm of the mineral soil surface for one month or more per year in 6 or more out of 10 years.

Key to subgroups

FBBA. Haplosalids which have a duripan that has its upper boundary within 100 cm of the soil surface.

Duric Haplosalids

FBBB. Other Haplosalids which have a petrogypsic horizon that has its upper boundary within 100 cm of the soil surface.

Petrogypsic Haplosalids

FBBC. Other Haplosalids which have a gypsic horizon that has its upper boundary within 100 cm of the soil surface.

Gypsic Haplosalids

FBBD. Other Haplosalids which have a calcic horizon that has its upper boundary within 100 cm of the soil surface.

Calcic Haplosalids

FBBE. Other Haplosalids.

Typic Haplosalids

Definition of Typic Haplosalids

Typic Haplosalids are the Haplosalids which do not have a calcic, gypsic, or petrogypsic horizon or a duripan that has an upper boundary within 100 cm of the soil surface.

Page 180, left column, Limits between Entisols and soils of other orders. Change item 3a. (refer to page 615-179) to read as follows:

"a. A salic horizon, if the upper boundary is within 100 cm of the soil surface, unless it is a buried horizon."

And in item 3c. after horizon, add the following:

"if the upper boundary is within 100 cm of the soil surface,"

Page 190, left column, lines 30 and 41. Change "Durorthids" to "Durids". And lines 22, 33, 47, and 48. Change "Durorthidic" to "Duridic"

Page 194, left column, line 7. Change "weak" to "partial" left column, line 9. Change "Durorthids" to "Durids", left column, line 29. Change "Durorthidic" to "Durinodic", left column, line 32 change "weakly cemented" to "partially Cemented".

Page 197, right column, lines 27. Change "Durorthidic" to "Haploduridic", right column, line, 31, change "have weak cementation" to "are partially cemented", right column, line 36, change "Durorthidic" to "Durinodic", right column, line 47, change "Durorthidic" to "Durinodic", right column, line 48 change "weakly cemented" to "partially cemented".

Page 201, right column, line 44. Change "Durorthidic" to "Duridic".

Page 205, left column, line 41. Change "Durorthidic" to "Haploduridic", left column, line 46 change "weakly" to "partially".

Page 209, left column, line 6. Change "Durorthidic" to "Durinodic".

Page 227, right column, Definition of Inceptisol. Replace item 1d. with the following:

"d. Do not have a salic horizon and saturation with water in one or more layers within 100 cm of the soil surface for 1 month or more per year in 6 out of 10 years;"

Page 228, Limits between Inceptisols and the other orders. Change item 3. (refer to 615-79) after the words salic horizon to the following: "and saturation with water in one or more layers within 100 cm of the soil surface for 1 month or more per year in 6 out of 10 years."

Page 257, left column, line 25. Delete "soft powdery lime" and replace with "identifiable secondary carbonates".

Page 285, left column, line 49. Change "Calciorthids" to "Calcids".

Page 298, right column, line 42. Delete "soft powdery lime" and replace with "identifiable secondary carbonates".

Page 301, left column, line 23. Delete "soft powdery lime" and replace with "identifiable secondary carbonates".

Page 302, right column, line 58. Delete "soft powdery or disseminated lime" and replace with "identifiable secondary carbonates".

Page 304, left column, line 51. Delete "soft powdery lime" and replace with "identifiable secondary carbonates".

NSTH 615.62, p. 615-344, HDEI. (see 615.90, p. 615-544). Delete "soft powdery lime" and replace with "identifiable secondary carbonates".

NSTH 615.62, p. 615-345, HDEQ. (see 615.90, p. 615-544). Delete "soft powdery lime" and replace with "identifiable secondary carbonates".

NSTH 615.62, p. 615-345, HDES. (see 615.90, p. 615-544) Delete "soft powdery lime" and replace with "identifiable secondary carbonates".

NSTH 615.62, p. 615-349, HDFI. Delete "soft powdery lime" and replace with "identifiable secondary carbonates".

NSTH 615.62, p. 615-349, HDFS. (see 615.89, p. 615-499). Delete "soft powdery lime" and replace with "identifiable secondary carbonates".

NSTH 615.62, p. 615-350, HDFZ. (see 615.89, p. 615-499). Delete "soft powdery lime" and replace with "identifiable secondary carbonates".

Page 304, right column, line 17. Change "Salorthidic" to "Salidic".

Page 305, left column, line 38. Change "Salorthidic" to "Salidic".

Page 308, right column, line 58. Change "Calciorthids" to "Calcids".

Page 309, left column, line 38. Change "Calciorthidic" to "Calcidic".

Page 312, right column, line 10. Change "Aridic Calcic" to "Calciargidic", right column, line 53 change "Durargidic" to "Argiduridic"

Page 318, left column, line 19. Change "Calciorthidic" to "Calcidic".

Page 321, right column, line 3. Change "Aridic Petrocalcic to "Petrocalcidic".

NSTH 615.26, p. 615-30, lines 9 and 18. Change "Orthidic" to "Haploduridic" and in the Definition of Typic Durustolls, "Argids" should be "Durids".

NSTH 615.62, p. 615-209, right column, item IAGG. (see p.615-516). Change "Durorthidic" to "Durinodic".

NSTH 615.62, p. 615-232, right column, item ICCG. (see p.615-519). Change "Salorthidic" to "Salidic".

NSTH 615.62, p. 615-234, left column, item ICFL. (see p. 615-445). Change "Calciorthidic" to "Calcidic".

NSTH 615.62, p. 615-268, right column, items KDDG. and KDDH. (see p. 615-465). Change "Durorthidic" to "Duridic".

NSTH 615.62, p. 615-271, left column, item KDBG. (see p. 615-467). Change "Durorthidic" to "Durinodic".

NSTH 615.62, p. 615-273, right column, items KEBH., KEBK., and KEBL. (see p. 615-468). Change "Durorthidic" to "Haploduridic".

NSTH 615.62, p. 615-276, right column, item KEEF. (see p. 615-469). Change "Durorthidic" to "Durinodic".

NSTH 615.62, p. 615-276, right column, items KECE. and KECH. (see page 615-469). Change "Durorthidic" to "Duridic".

NSTH 615.62, p. 615-278, right column, items KCBB. and KCBC. Change "Durorthidic" to "Haploduridic".

NSTH 615.62, p. 615-280, right column, items KCFB. and KCFE. (see p. 615-473). Change "Durorthidic" to "Durinodic".

NSTH 615.62, p. 615-317, right column, item HEDB. Change "Abruptic Aridic" to "Paleargidic"

NSTH 615.62, p. 615-322, left column, item HEGA. Change "Salorthidic" to "Salidic".

NSTH 615.62, p. 615-334, left column, item HFDA. Change"Salorthidic" to "Salidic".

NSTH 615.62, p. 615-336, left column, item HFAB. Change "Orthidic" to "Haploduridic", and HFAC. Change "Aridic" to "Argiduridic".

NSTH 615.62, p. 615-336, right column, item HFGA. Change"Salorthidic" to "Salidic".

NSTH 615.62, p. 615-342, left column, item HFCG. Change"Calciorthidic" to "Calciargidic".

NSTH 615.62, p. 615-351, right column, item HDCE. Change "Aridic Petrocalcic" to "Petrocalcidic".

NSTH 615.62, p. 615-349, right column, item HDFS. (see p.615-499). Change "Calciorthidic" to "Calcidic".

NSTH 615.89, p. 615-479, left column, item JAAA. Change "Salorthidic" to "Salidic".

NSTH 615.101, p. 615-598, right column, item JDEL. Change "Calciorthidic" to "Haplocalcidic".

615.116 Subgroups of Durixerolls

The subgroups of Durixerolls are revised based in part on the recommendations made in the final report of the International Committee on Aridisols.

Page 315 and NSTH 615.62 p. 615-347 Delete all subgroups of Durixerolls following HDAC (changed to HDAD NSTH 615.90 P.á615-545) Aquic Durixerolls and insert the following subgroups:

"HDAE. Other Durixerolls which have:

1. An aridic moisture regime; *and*

2. An argillic horizon that has a clay increase with depth *either* of 20 percent or more (absolute) within 7.5 cm, *or* of 15 percent or more (absolute) within 2.5 cm; *and*

3. A duripan that is neither very strongly cemented nor indurated in any subhorizon.

Paleargidic Durixerolls

HDAF. Other Durixerolls which have *both*:

1. An aridic moisture regime; *and*

2. An argillic horizon that has a clay increase with depth *either* of 20 percent or more (absolute) within 7.5 cm, *or* of 15 percent or more (absolute) within 2.5 cm.

Abruptic Argiduridic Durixerolls

HDAG. Other Durixerolls which:

1. Have an aridic moisture regime; *and*

2. Do not have an argillic horizon above the duripan; *and*

3. Have a duripan that is neither very strongly cemented nor indurated in any subhorizon.

Cambidic Durixerolls

HDAH. Other Durixerolls which:

1. Have an aridic moisture regime; *and*

2. Do not have an argillic horizon above the duripan.

Haploduridic Durixerolls

HDAI. Other Durixerolls which have;

1. An aridic moisture regime; *and*

2. A duripan that is neither very strongly cemented nor indurated in any subhorizon.

Argidic Durixerolls

HDAJ. Other Durixerolls that have an aridic moisture regime.

Argiduridic Durixerolls

HDAK. Other Durixerolls which have: *both*

1. An argillic horizon that has a clay increase with depth *either* of 20 percent or more (absolute) within 7.5 cm, *or* of 15 percent or more (absolute) within 2.5 cm; *and*

2. A duripan that is neither very strongly cemented nor indurated in any subhorizon.

Haplic Palexerollic Durixerolls

HDAL. Other Durixerolls which have an argillic horizon that has a clay increase with depth *either* of 20 percent or more (absolute) within 7.5 cm, *or* of 15 percent or more (absolute) within 2.5 cm.

Palexerollic Durixerolls

HDAM. Other Durixerolls which:

1. Have a duripan that is neither very strongly cemented nor indurated in any subhorizon; *and*

2. Do not have an argillic horizon above the duripan.

Haplic Haploxerollic Durixerolls

HDAN. Other Durixerolls which do not have an argillic horizon above the duripan.

Haploxerollic Durixerolls

HDAO. Other Durixerolls which have a duripan that is neither very strongly cemented nor indurated in any subhorizon.

Haplic Durixerolls

HDAP. Other Durixerolls.

Typic Durixerolls"

NSTH 615.62, p. 615-347, Definition of Typic Durixerolls, replace statements 1., 2., and 6. with the following:

"1. Do not have an argillic horizon that has a clay increase with depth *either* of 20 percent or more (absolute) within 7.5 cm, *or* of 15 percent or more (absolute) within 2.5 cm;"

"2. Have a duripan that is either very strongly cemented or indurated in some subhorizon;"

"6. Do not have, throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the mineral 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 of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more."

615.117 Definition of particle-size classes

Page 384 and NSTH 615.68, p. 615-396. Move footnote to follow "Definition of classes" and change the first sentence to read:

"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, then the percentage of clay is estimated with the following formula:

Clay % = 2.5(% water retained at 1500 kPa tension -% organic carbon)

If the product is more than 100 the clay content is estimated at 100 percent."

615.118 Revised criteria for Vitrandic and Aquandic subgroups

The criteria for Vitrandic subgroups and the "vitrandic" part of the Aquandic subgroups have been rewritten to make them easier to understand. Replace the present Aquandic criteria with the following criteria as indicated below:

"(--) Other (----) that have, throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the mineral soil surface, *one or more* of the following:

1. A fine-earth fraction with both a bulk density of 1.0 g/cm^3 or less, measured at 33 kPa water retention, and aluminum plus 1/2 iron percentages (by ammonium oxalate) totaling more than 1.0; *or*

2. 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*

3. A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more."

NSTH 615.62, p. 615-209, IAGE. (see 615.90, p. 615-516).

NSTH 615.89, p. 615-428, IAJA.

NSTH 615.89, p. 615-429, IAIB.

NSTH 615.62, p. 615-215, IAHA.

NSTH 615.62, p. 615-263, KAEE. (see 615.89, p. 615-461).

NSTH 615.62, p. 615-262, KACA.

NSTH 615.62, p. 615-290, JAEJ. (see 615.89, p. 615-475).

NSTH 615.89, p. 615-476, JAJD.

NSTH 615.62, p. 615-291, JACB.

NSTH 615.62, p. 615-294, JAHC.

NSTH 615.62, p. 615-294, JABB.

NSTH 615.62, p. 615-295, JAGE.

NSTH 615.62, p. 615-314, HABF. (see 615.90, p. 615-532).

NSTH 615.62, p. 615-315, HBAE. (see 615.90, p. 615-533).

NSTH 615.89, p. 615-489, HBGE.

NSTH 615.89, p. 615-490, HBFD.

Replace the indicated Vitrandic criteria with the following criteria as indicated below:

(-) A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more."

NSTH 615.62, p. 615-215, IBDE. (see 615.90, p. 615-516). Item 2.:

NSTH 615.62, p. 615-216, IBED. (see 615.90, p. 615-516). Item 2.:

NSTH 615.62, p. 615-218, IBBB. Item 2.:

NSTH 615.62, p. 615-218, IBFC. Item 2.:

NSTH 615.62, p. 615-219, IBAB. Item 2.:

NSTH 615.89, p. 615-438, IEEB. (see 5th edition of the *Keys to Soil Taxonomy*). Item 2c.:

NSTH 615.89, p. 615-438, IEED. (see 5th edition of the *Keys to Soil Taxonomy*). Item 2.:

NSTH 615.62, p. 615-222, IEKF. (see NSTH 615.89, p. 615-439). Item 2.:

NSTH 615.62, p. 615-236, IDCB. Item 2.:

NSTH 615.89, p. 615-446, IDGE. Item 2c.:

NSTH 615.62, p. 615-237, IDGG. (see 615.89, p. 615-446). Item 2.:

NSTH 615.89, p. 615-447, IDFB. Item 2c.:

NSTH 615.62, p. 615-239, IDFD. (see 615.89, p. 615-447). Item 2.:

NSTH 615.62, p. 615-267, KDAB. Item 2.:

NSTH 615.62, p. 615-268, KDDC. Item 3b. (see *Keys to Soil Taxonomy*, 5th edition):

NSTH 615.62, p. 615-268, KDDD. Item 2.:

NSTH 615.62, p. 615-269, KDFB. Item 2.:

NSTH 615.89, p. 615-467, KDBB. Item 3c.:

NSTH 615.89, p. 615-467, KDBD. Item 2.:

NSTH 615.62, p. 615-271, KEAC. Item 2.:

NSTH 615.62, p. 615-273, KEBG. Item 2.:

NSTH 615.62, p. 615-274, KEDC. Item 2.:

NSTH 615.62, p. 615-275, KEFC. (see *Keys to Soil Taxonomy*, 5th edition). Item 2.:

NSTH 615.89, p. 615-469, KECB. Item 2c.:

NSTH 615.62, p. 615-276, KECD. (see 615.89, p. 615-469). Item 2.:

NSTH 615.62, p. 615-296, JDDD. (see 615.89, p. 615-480). Item 2.:

NSTH 615.89, p. 615-480, JDCA. Item 2c.:

NSTH 615.89, p. 615-480, JDCC. Item 2.:

NSTH 615.89, p. 615-481, JDHD. Item 2c.:

NSTH 615.62, p. 615-298, JDHF. (see 615.89, p. 615-481). Item 2.:

NSTH 615.62, p. 615-300, JDGE. (see 615.89, p. 615-482). Item 2.:

NSTH 615.62, p. 615-301, JDBB. (see 615.89, p. 615-479). Item 2.:

NSTH 615.62, p. 615-302, JDEF. (see 615.89, p. 615-483). Item 2.:

NSTH 615.89, p. 615-483, JDFG. Item 2c.:

NSTH 615.62, p. 615-304, JDFI. (see 615.89, p. 615-483). Item 2.:

NSTH 615.62, p. 615-306, JCEE. Item 2.:

NSTH 615.62, p. 615-307, JCDE. (see 615.89, p. 615-484). Item 2. with:

NSTH 615.62, p. 615-308, JCAF. (see 615.89, p. 615-484). Item 2.:

NSTH 615.62, p. 615-310, JEBF. Item 2.:

NSTH 615.62, p. 615-311, JEAB. Item 2.:

NSTH 615.62, p. 615-311, JEDD. Item 2.:

NSTH 615.62, p. 615-313, JECC. Item 2.:

NSTH 615.62, p. 615-318, HEDJ. (see 615.90, p. 615-534). Item 2.:

NSTH 615.62, p. 615-321, HEBK. Item 2.:

NSTH 615.62, p. 615-323, HEGG. Item 2.:

NSTH 615.62, p. 615-328, HGCF. (see 615.90 p. 615-537). Item 2.:

NSTH 615.62, p. 615-329, HGEF. (see 615.90, p. 615-538). Item 2.:

NSTH 615.62, p. 615-332, HFEG. Item 2b.:

NSTH 615.62, p. 615-332, HFEH. Item 2.:

NSTH 615.62, p. 615-338, HFGJ. (see 615.106, p. 615-601). Item 2b.:

NSTH 615.62, p. 615-338, HFGK. (see 615.106, p. 615-601). Item 2.:

NSTH 615.62, p. 615-344, HDEF. (see 615.90, p. 615-544). Item 2b.:

NSTH 615.62, p. 615-344, HDEG. (see 615.90, p. 615-544). Item 2.:

NSTH 615.62, p. 615-346, HDAB. (see 615.90, p. 615-545). Item 2b.:

NSTH 615.62, p. 615-347, HDAC. (see 615.90, p. 615-545). Item 2.:

NSTH 615.62, p. 615-348, HDFE. Item 2b.:

NSTH 615.62, p. 615-348, HDFF. Item 2.:

And because the criteria for Vitrandic subgroups and the "vitrandic" part of the Aquandic subgroups have been rewritten, replace the indicated statements with the following statement:

"(-) A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more."

NSTH 615.62, p. 615-210, Definition of Typic Albaqualfs. Item 2c.:

NSTH 615.89, p. 615-429, Definition of Typic Endoaqualfs. Item 2c.:

NSTH 615.89, p. 615-431, Definition of Typic Epiaqualfs. Item 2c.:

NSTH 615.89, p. 615-432, Description of Aquandic Epiaqualfs. Item 3.:

NSTH 615.62, p. 615-215, Definition of Typic Umbraqualfs. Item 1c.:

NSTH 615.62, p. 615-216, Definition of Typic Cryoboralfs. Item 1c.:

NSTH 615.62, p. 615-217, Definition of Typic Eutroboralfs. Item 8c. (see 615.89, p. 615-435):

NSTH 615.62, p. 615-218, definition of Typic Fragiboralfs. Item 3c. (see 615.89, p. 615-435):

NSTH 615.62, p. 615-219, Definition of Typic Glossoboralfs. Item 6c. (see 615.62, p. 615-436):

NSTH 615.62, p. 615-219, Definition of Typic Paleboralfs. Item 2c.:

NSTH 615.89, p. 615-438, Definition of Typic Glossudalfs. Item 6c.:

NSTH 615.62, p. 615-224, Definition of Typic Hapludalfs. Item 2c.:

NSTH 615.62, p. 615-237, Definition of Typic Fragixeralfs. Item 2c.:

NSTH 615.62, p. 615-239, Definition of Typic Haploxeralfs. Item 11c.:

NSTH 615.62, p. 615-240, Definition of Typic Palexeralfs. Item 11c.:

NSTH 615.62, p. 615-263, Definition of Typic Cryaquents. Item 1c.:

NSTH 615.62, p. 615-264, Definition of Typic Fluvaquents. Item 2c.:

NSTH 615.62, p. 615-267, Definition of Typic Cryofluvents. Item 1c.:

NSTH 615.62, p. 615-268, Definition of Typic Torrifluvents. Item 5b.:

NSTH 615.62, p. 615-269, Definition of Typic Udifluvents. Item 1c.:

NSTH 615.89, p. 615-467, Definition of Typic Xerofluvents. Item 5c.:

NSTH 615.62, p. 615-272, Definition of Typic Cryorthents. Item 1b.:

NSTH 615.62, p. 615-273, Definition of Typic Torriorthents. Item 7b. (see 615.89, p. 615-468):

NSTH 615.62, p. 615-274, Definition of Typic Troporthents. Item 1c.:

NSTH 615.62, p. 615-275, Definition of Typic Udorthents. Item 1c.:

NSTH 615.62, p. 615-276, Definition of Typic Xerorthents. Item 6c. (see 615.89, p. 615-470):

NSTH 615.62, p. 615-290, Definition of Typic Cryaquepts. Item 2c.:

NSTH 615.89, p. 615-477, Definition of Typic Endoaquepts. Item 3c.:

NSTH 615.62, p. 615-291, Definition of Typic Halaquepts. Item 4c.:

NSTH 615.62, p. 615-294, Definition of Typic Humaquepts. Item 2c.:

NSTH 615.62, p. 615-295, Definition of Typic Placaquepts. Item 3c.:

NSTH 615.62, p. 615-296, Definition of Typic Tropaquepts. Item 7c.:

NSTH 615.62, p. 615-297, Definition of Typic Cryochrepts. Item 5c. (see 615.89, p. 615-480):

NSTH 615.89, p. 615-480, Definition of Typic Durochrepts. Item 5c.:

NSTH 615.62, p. 615-299, Definition of Typic Dystrochrepts. Item 1c.:

NSTH 615.62, p. 615-300, Definition of Typic Eutrochrepts. Item 1c.:

NSTH 615.62, p. 615-301, Definition of Typic Fragiochrepts. Item 1c.:

NSTH 615.62, p. 615-303, Definition of Typic Ustochrepts. Item 7c. (see 615.89, p. 615-483):

NSTH 615.62, p. 615-305, Definition of Typic Xerochrepts. Item 7c.:

NSTH 615.62, p. 615-306, Definition of Typic Dystropepts (see 615.89, p. 615-484). Item 3c.:

NSTH 615.62, p. 615-308, Definition of Typic Eutropepts. Item 1c.:

NSTH 615.62, p. 615-309, Definition of Typic Humitropepts. Item 1c.:

NSTH 615.62, p. 615-310, Definition of Typic Cryumbrepts. Item 1c.:

NSTH 615.62, p. 615-311, Definition of Typic Fragiumbrepts. Item 1c.:

NSTH 615.62, p. 615-312, Definition of Typic Haplumbrepts. Item 2.:

NSTH 615.62, p. 615-313, Definition of Typic Xerumbrepts. Item 6c.:

NSTH 615.62, p. 615-314, Definition of Typic Argialbolls. Item 1c.:

NSTH 615.62, p. 615-316, Definition of Typic Cryaquolls. Item 1c.:

NSTH 615.89, p. 615-489, Definition of Typic Endoaquolls. Item 5c.:

NSTH 615.89, p. 615-490, Definition of Typic Epiaquolls. Item 4c.:

NSTH 615.62, p. 615-319, Definition of Typic Argiborolls. Item 3c.:

NSTH 615.62, p. 615-322, Typic Cryoborolls. Item 2c.:

NSTH 615.62, p. 615-324, Definition of Typic Haploborolls. Item 1c.:

NSTH 615.62, p. 615-328, Definition of Typic Argiudolls. Item 7c. (see 615.89, p. 615-494):

NSTH 615.62, p. 615-320, Definition of Typic Hapludolls. Item 8c. (see 615.90, p. 615-538):

NSTH 615.62, p. 615-333, Definition of Typic Argiustolls. Item 9c.:

NSTH 615.62, p. 615-339, Definition of Typic Haplustolls. Item 13c. (see 615.89, p. 615-497):

NSTH 615.62, p. 615-345, Definition of Typic Argixerolls. Item 11c. (see 615.89, p. 615-498):

NSTH 615.62, p. 615-350, Definition of Typic Haploxerolls. Item 13b. (see 615-89, p. 615-500):

615.119 Addition of Vitrandic subgroups

Soil series that meet the criteria for "vitrandic" subgroups have been established in the great groups of Cryopsamments, Torripsamments, Xeropsamments, and Calcixerolls. Fourteen of these soil series are Psamments in ashy families. Particle-size families should not be used with Psamments. Vitrandic subgroups would be appropriate for all of these soils.

Page 202 and NSTH 615.62 p. 615-277 following item KCAD. added NSTH 615.89 p. 615-471 add:

"KCAE. Other Cryopsamments that have, throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the mineral soil surface, a fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

Vitrandic Cryopsamments"

And renumber items KCAE. through KCAG. as KCAF. through KCAH.

Page 205 and NSTH 615.62 p. 615-277, description of Typic Cryopsamments, following item 6. renumbered in NSTH 615.89 p. 615-471 add item 7. as follows:

"7. Do not have, throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the mineral soil surface, a fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more."

NSTH 615.62 p. 615-278 following item KCBA. add:

"KCBB. Other Torripsamments that have, throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the mineral soil surface, a fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

Vitrandic Torripsamments"

And renumber items KCBB. through KCBF. to KCBC. through KCBG.

NSTH 615.62 p. 615-279, description of Typic Torripsamments add item 4. as follows:

"4. Do not have, throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the mineral soil surface, a fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more."

Page 208 and NSTH 615.62 p. 615-280 following item KCFD. added NSTH 615.89 p. 615-473 add:

"KCFE. Other Xeropsamments that have, throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the mineral soil surface, a fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

Vitrandic Xeropsamments"

And renumber items KCFE. through KCFH. to KCFF. through KCFI.

NSTH 615.62 p. 615-281, description of Typic Xeropsamments add following item 6. renumbered in NSTH 615.89 p. 615-473 item 6. as follows:

"7. Do not have, throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the mineral soil surface, a fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more."

Page 314 and NSTH 615.62 p. 615-346 following item HDDE. added NSTH 615.89 p. 615-499 add:

"HDDF. Other Calcixerolls that have, throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the mineral soil surface, one or both of the following:

1. 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

2. A fine-earth fraction containing 30 percent or more particles 0.02 to 2.0 mm in diameter of which

5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more.

Vitrandic Calcixerolls"

And renumber items HDDF. through HDDH. to HDDG. through HDDI.

NSTH 615.62 p. 615-346, description of Typic Calcixerolls following item 7. renumbered in NSTH 615.89 p. 615-499 add item 8. as follows:

"8. Do not have, throughout one or more horizons with a total thickness of 18 cm or more within 75 cm of the mineral 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 of which 5 percent or more is volcanic glass, and [(Al plus 1/2 Fe, percent extracted by ammonium oxalate) times 60] plus the volcanic glass (percent) is 30 or more."

615.120 Strongly Contrasting Particle-size Classes

NSTH 615.60, p. 615-207 (revised 615.112 p. 615-605) (*Soil Taxonomy* p. 386). Following item 48. Medial over sandy or sandy-skeletal. (added NSTH 615.112 p. 615-605) add new item 49. to read as follows:.

"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."

And renumber items 49. through 55. as 50. through 56.

615.121 Humaqueptic and Mollic subgroups of Aquents and Aquepts

This amendment changes the criteria for Humaqueptic and Mollic subgroups of Aquents and Aquepts to allow for mixing when determining color of the surface layer and clarifies the base status requirement. Also Humic and Mollic subgroups are added in Epiaquepts.

NSTH 615.89 p. 615-462 item KAGD. and KAGE. Replace with the following:

"KAGD. Other Endoaquents which have *both*:

1. An Ap horizon that has a color value, moist, of 3 or less and a color value, dry, of 5 or less (crushed and smoothed), *or* the upper soil to a depth of 15 cm, after mixing, has these colors; *and*

2. A base saturation (by NH_4OAc) of less than 50 percent, in some part, within a depth of 100 cm from the mineral soil surface.

Humaqueptic Endoaquents

KAGE. Other Endoaquents which have *either* an Ap horizon that has a color value, moist, of 3 or less and a color value, dry, of 5 or less (crushed and smoothed), *or* the upper soil to a depth of 15 cm, after mixing, has these colors."

Mollic Endoaquents"

NSTH 615.89 p. 615-462 Definition of Typic Endoaquents, replace item 2. with the following:

"2. Have an Ap horizon that has a color value, moist, of 4 or more or a color value, dry, of 6 or more (crushed and smoothed), *or* the upper soil to a depth of 15 cm, after mixing, has these colors;"

NSTH 615.89 p. 615-463 Replace items KAFB. and KAFC. with the following:

"KAFB. Other Epiaquents which have *both*:

1. An Ap horizon that has a color value, moist, of 3 or less and a color value, dry, of 5 or less (crushed and smoothed), *or* the upper soil to a depth of 15 cm, after mixing, has these colors *and*"

2. A base saturation (by NH_4OAc) of less than 50 percent, in some part, within a depth of 100 cm from the mineral soil surface.

Humaqueptic Epiaquents

KAFC. Other Epiaquents which have *either* an Ap horizon that has a color value, moist, of 3 or less and a color value, dry, of 5 or less (crushed and smoothed), *or* the upper soil to a depth of 15 cm, after mixing, has these colors.

Mollic Epiaquents"

NSTH 615.89 p. 615-463 Definition of Typic Epiaquents, replace item 3. with the following:

"2. An Ap horizon that has a color value, moist, of 4 or more or a color value, dry, of 6 or more (crushed and smoothed), *or* the upper soil to a depth of 15 cm, after mixing, has these colors."

Page 183 and NSTH 615.62 p. 615-264. Replace items KAEI. and KAEJ. with the following:

"KAEI. Other Fluvaquents which have *both*:

1. An Ap horizon that has a color value, moist, of 3 or less and a color value, dry, of 5 or less (crushed and smoothed), *or* the upper soil to a depth of 15 cm, after mixing, has these colors *and*"

2. A base saturation (by NH_4OAc) of less than 50 percent, in some part, within a depth of 100 cm from the mineral soil surface.

Humaqueptic Fluvaquents

KAEJ. Other Fluvaquents which have *either* an Ap horizon that has a color value, moist, of 3 or less and a color value, dry, of 5 or less (crushed and smoothed), *or* the upper soil to a depth of 15 cm, after mixing, has these colors.

Mollic Fluvaquents"

NSTH 615.62 p. 615-265 Definition of Typic Fluvaquents, replace item 4. with the following:

"4. Have an Ap horizon that has a color value, moist, of 4 or more or a color value, dry, of 6 or more (crushed and smoothed), *or* the upper soil to a depth of 15 cm, after mixing, has these colors;"

Page 186 and NSTH 615.62 p. 615-266 and NSTH 615.89, p. 615-464. Replace items KADC. and KADD. with the following:

"KADC. Other Psammaquents which have *both*:

1. An Ap horizon that has a color value, moist, of 3 or less and a color value, dry, of 5 or less (crushed and smoothed), *or* the upper soil to a depth of 15 cm, after mixing, has these colors *and*

2. A base saturation (by NH_4OAc) of less than 50 percent, in some part, within a depth of 100 cm from the mineral soil surface.

Humaqueptic Psammaquents

KADD. Other Psammaquents which have *either* an Ap horizon that has a color value, moist, of 3 or less and a color value, dry, of 5 or less (crushed and smoothed), *or* the upper soil to a depth of 15 cm, after mixing, has these colors.

Mollic Psammaquents"

NSTH 615.62 p. 615-266 Definition of Typic Psammaquents, replace item 2. with the following:

"2. Have an Ap horizon that has a color value, moist, of 4 or more or a color value, dry, of 6 or more (crushed and smoothed), *or* the upper soil to a depth of 15 cm, after mixing, has these colors;"

NSTH 615.89 p. 615-476 replace items JAJF. and JAJG. with the following:

"JAJF. Other Endoaquepts which have *both*:

1. An Ap horizon that has a color value, moist, of 3 or less and a color value, dry, of 5 or less (crushed and smoothed), *or* the upper soil to a depth of 15 cm, after mixing, has these colors *and*

2. A base saturation (by NH_4OAc) of less than 50 percent in some part, within 100 cm of the mineral soil surface.

Humic Endoaquepts

JAJG. Other Endoaquepts which have either an Ap horizon that has a color value, moist, of 3 or less and a color value, dry, of 5 or less (crushed and smoothed), *or* the upper soil to a depth of 15 cm, after mixing, has these colors.

Mollic Endoaquepts"

NSTH 615.89 p. 615-477 Definition of Typic Endoaquepts, replace item 2. with the following:

"2. An Ap horizon that has a color value, moist, of 4 or more or a color value, dry, of 6 or more (crushed and smoothed), *or* the upper soil to a depth of 15 cm, after mixing, has these colors;"

NSTH 615.89 p. 615-478 add the following items, JAIC. and JAID.:

"JAIC. Other Epiaquepts which have *both*:

1. An Ap horizon that has a color value, moist, of 3 or less and a color value, dry, of 5 or less (crushed and smoothed), *or* the upper soil to a depth of 15 cm, after mixing, has these colors *and*

2. A base saturation (by NH_4OAc) of less than 50 percent in some part, within 100 cm of the mineral soil surface.

Humic Epiaquepts

JAID. Other Epiaquepts which have an Ap horizon that has a color value, moist, of 3 or less *and* a color value, dry, of 5 or less (crushed and smoothed), *or* the upper soil to a depth of 15 cm, after mixing, has these colors.

Mollic Epiaquepts"

And renumber item JAIC. to JAIE.

NSTH 615.89 p. 615-478 Definition of Typic Epiaquepts, add following item 2. item 3. as follows:

"3. An Ap horizon that has a color value, moist, of 4 or more or a color value, dry, of 6 or more (crushed and smoothed), *or* the upper soil to a depth of 15 cm, after mixing, has these colors."

615.122 Subgroups of Psamments

The criteria for argic subgroups are clarified and made consistent between the great groups. An aridic subgroup is added to Ustipsamments.

Page 202 and NSTH 615.62 p. 615-277 (Revised in NSTH 615.72 p. 615-397) Replace item KCAF. with the following:

"KCAF. Other Cryopsamments which have lamellae within 200 cm of the mineral soil surface that meet all the requirements for an argillic horizon except for thickness or clay content or both.

Argic Cryopsamments"

Page 204 and NSTH 615.62 p. 615-277 Definition of Typic Cryopsamments (Soil Taxonomy p. 202), replace item 1. with the following:

"1. Do not have lamellae within 200 cm of the mineral soil surface that meet all the requirements for an argillic horizon except for thickness or clay content or both.

NSTH 615.62 p. 615-278 (Revised in NSTH 615.72 p. 615-397) Replace item KCCH. and KCCI. with the following:

"KCCH. Other Quartzipsamments which have:

1. Lamellae within 200 cm of the mineral soil surface that meet all the requirements for an argillic horizon except for thickness or clay content or both; *and*

2. An ustic moisture regime.

Argic Ustic Quartzipsamments

KCCI. Other Quartzipsamments which have lamellae within 200 cm of the mineral soil surface that meet all the requirements for an argillic horizon except for thickness or clay content or both.

Argic Quartzipsamments"

Page 206 and NSTH 615.72 p. 615-397 Definition of Typic Quartzipsamments, column 2 (Soil Taxonomy p. 204) replace item 7. (renumbered in NSTH 615.89 p. 615-471 to 8.) with the following:

"8. Do not have lamellae within 200 cm of the mineral soil surface that meet all the requirements for an argillic horizon except for thickness or clay content or both.

NSTH 615.62 p. 615-279 (Revised in NSTH 615.72 p. 615-398) Replace item KCGE. with the following:

"KCGE. Other Udipsamments which have lamellae within 200 cm of the mineral soil surface that meet all the requirements for an argillic horizon except for thickness or clay content or both.

Argic Udipsamments"

NSTH 615.62 p. 615-279 Definition of Typic Udipsamments, column 2 (Soil Taxonomy p. 206) replace item 1. with the following:

"1. Do not have lamellae within 200 cm of the mineral soil surface that meet all the requirements for an argillic horizon except for thickness or clay content or both.

Page 207 and NSTH 615.62 p. 615-280 (Revised in NSTH 615.72 p. 615-398) After KCEC. add new KCED., replace item KCED. with KCEE. and change the numbering of item KCEE. to KCEF.:

"KCED. Other Ustipsamments which, if neither irrigated nor fallowed to store moisture, have *one* of 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 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, 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 Ustipsamments"

"KCEE. *Other Ustipsamments* which have lamellae within 200 cm of the mineral soil surface that meet all the requirements for an argillic horizon except for thickness or clay content or both.

Argic Ustipsamments"

NSTH 615.62 p. 615-280 (revised 615.72 p. 615-398) Definition of Typic Ustipsamments, column 1 (Soil Taxonomy p. 207) replace item 1. with the following:

"1. Do not have lamellae within 200 cm of the mineral soil surface that meet all the requirements for an argillic horizon except for thickness or clay content or both."

NSTH 615.62, p. 615-280 add number 5. as follows:

"5. Are either irrigated or fallowed to store moisture, or 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 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, is moist in some or all parts for 180 or more cumulative days per year when the temperature at a depth of 50 cm below the soil surface is higher than 8°C."

Page 208 and NSTH 615.62 p. 615-280 (Revised in NSTH 615.72 p. 615-398) Replace item KCFF. with the following:

"KCFF. Other Ustipsamments which have lamellae within 200 cm of the mineral soil surface that meet all the requirements for an argillic horizon except for thickness or clay content or both.

Argic Xeropsamments"

NSTH 615.62 p. 615-280 Definition of Typic Xeropsamments, column 2 (Soil Taxonomy p. 208) replace item 1. with the following:

"1. Do not have lamellae within 200 cm of the mineral soil surface that meet all the requirements for an argillic horizon except for thickness or clay content or both."

615.123 Fibric, Hemic, and Sapric subgroups of Histosols

In the suborder Hemists "One or more layers, with a total thickness of 12.5 cm or more," should have been "One or more layers, with a combined thickness of 25 cm or more," in items ACED., ACEI., ACGD., ACGI., ACFD., and ACFI. The criteria for Fibric, Hemic, and Sapric subgroups of Histosols are difficult to understand. The following changes are intended to make the criteria more easily understood without changing the meaning.

Page 213 and NSTH 615.62 p. 615-281 change item ABCD.1. to:

"1. Have one or more layers, with a combined thickness of 25 cm or more, consisting of hemic materials below the surface tier; *and*"

Change item ABCE.1. to:

"1. Have one or more layers, with a combined thickness of 12.5 cm or more, consisting of sapric materials below the surface tier; *and*"

Change item ABCJ. to:

"ABCJ. Other Borofibrists that have one or more layers, with a combined thickness of 25 cm or more, consisting of hemic materials below the surface tier.

Hemic Borofibrists"

Change item ABCK. to:

"ABCK. *Other Borofibrists* that have one or more layers, with a combined thickness of 12.5 cm or more, consisting of sapric materials below the surface tier.

Sapric Borofibrists"

Page 213 and NSTH 615.62 p. 615-281, definition of Typic Borofibrists change item 1. to read:

"1. Have:

a. Less than 25 cm consisting of hemic materials below the surface tier; *and*"

b. Less than 12.5 cm consisting of sapric materials below the surface tier;"

Page 215 and NSTH 615.62 p. 615-282. Change item ABED.1. (changed to ABFD.1. in NSTH 615.89) to:

"1. One or more layers, with a combined thickness of 25 cm or more, consisting of hemic materials below the surface tier; *and*"

Change item ABEE.1. (changed to ABFE.1. in NSTH 615.89) to:

"1. One or more layers, with a combined thickness of 12.5 cm or more, consisting of sapric materials below the surface tier; *and*"

Change item ABEJ. (changed to ABFJ. in NSTH 615.89) to:

"ABFJ. Other Medifibrists that have one or more layers, with a combined thickness of 25 cm or more, consisting of hemic materials below the surface tier.

Hemic Medifibrists"

Change item ABEK. (changed to ABFK. in NSTH 615.89) to:

"ABFK. Other Medifibrists that have one or more layers, with a combined thickness of 12.5 cm or more, consisting of sapric materials below the surface tier.

Sapric Medifibrists"

Page 215 and NSTH 615.62 p. 615-282, definition of Typic Medifibrists change item 1. to read:

"1. Have:

a. Less than 25 cm consisting of hemic materials below the surface tier; *and*"

b. Less than 12.5 cm consisting of sapric materials below the surface tier;"

Page 216 and NSTH 615.62 p. 615-283 change item ABAH. to:

"ABAH. Other Sphagnofibrists that have one or more layers, with a combined thickness of 25 cm or more, consisting of hemic materials below the surface tier.

Hemic Sphagnofibrists"

Change item ABAI. to:

"ABAI. Other Sphagnofibrists that have one or more layers, with a combined thickness of 12.5 cm or more, consisting of sapric materials below the surface tier.
Sapric Sphagnofibrists"

Page 216 and NSTH 615.62 p. 615-283, definition of Typic Sphagnofibrists change item 2. to read:

"2. Have:

a. Less than 25 cm consisting of hemic materials below the surface tier; *and"*

b. Less than 12.5 cm consisting of sapric materials below the surface tier;"

Page 217 and NSTH 615.62 p. 615-283, change item ABDC.1. to:

"1. One or more layers, with a combined thickness of 25 cm or more, consisting of hemic materials below the surface tier; *and"*

Change item ABDD.1. to:

"1. One or more layers, with a combined thickness of 12.5 cm or more, consisting of sapric materials below the surface tier; *and"*

Change item ABDH. to:

"ABDH. Other Tropofibrists that have one or more layers, with a combined thickness of 25 cm or more, consisting of hemic materials below the surface tier.
Hemic Tropofibrists"

Change item ABDI. to:

"ABDI. Other Tropofibrists that have one or more layers, with a combined thickness of 12.5 cm or more, consisting of sapric materials below the surface tier.
Sapric Tropofibrists"

Page 217 and NSTH 615.62 p. 615-283, definition of Typic Tropofibrists change item 1. to read:

"1. Have:

a. Less than 25 cm consisting of hemic materials below the surface tier; *and"*

b. Less than 12.5 cm consisting of sapric materials below the surface tier;"

Page 220 and NSTH 615.62 p. 615-285 change item ACEC.1. to:

"1. One or more layers, with a combined thickness of 25 cm or more, consisting of fibric materials below the surface tier; *and"*

Change item ACED.1. to:

"1. One or more layers, with a combined thickness of 25 cm or more, consisting of sapric materials below the surface tier; *and"*

Change item ACEH. to:

"ACEH. Other Borohemists that have one or more layers, with a combined thickness of 25 cm or more, consisting of fibric materials below the surface tier.
Fibric Borohemists"

Change item ACEI. to:

"ACEI. Other Borohemists that have one or more layers, with a combined thickness of 25 cm or more, consisting of sapric materials below the surface tier.
Sapric Borohemists"

Page 220 and NSTH 615.62 p. 615-285, definition of Typic Borohemists change item 2. to read:

"2. Have:

a. Less than 25 cm consisting of fibric materials below the surface tier; *and"*

b. Less than 25 cm consisting of sapric materials below the surface tier;"

Page 222 and NSTH 615.62 p. 615-286 change item ACEC.1. (changed to ACGC.1.) to:

"1. One or more layers, with a combined thickness of 25 cm or more, consisting of fibric materials below the surface tier; *and"*

Change item ACED.1.(changed to ACGD.1. in NSTH 615.89) to:

"1. One or more layers, with a combined thickness of 25 cm or more, consisting of sapric materials below the surface tier; *and"*

Change item ACEH.(changed to ACGH. in NSTH 615.89) to:

"ACGH. Other Medihemists that have one or more layers, with a combined thickness of 25 cm or more, consisting of fibric materials below the surface tier.
Fibric Medihemists"

And change item ACEI.(changed to ACGI. in NSTH 615.89) to:

"ACGI. Other Medihemists that have one or more layers, with a combined thickness of 25 cm or more, consisting of sapric materials below the surface tier.
Sapric Medihemists"

Page 222 and NSTH 615.62 p. 615-286, definition of Typic Medihemists change item 2. to read:

"2. Have:

a. Less than 25 cm consisting of fibric materials below the surface tier; *and"*

b. Less than 25 cm consisting of sapric materials below the surface tier;"

Page 223 and NSTH 615.62 p. 615-287 change item ACEC.1. (changed to ACFC.1. in NSTH 615.89) to:

"1. One or more layers, with a combined thickness of 25 cm or more, consisting of fibric materials below the surface tier; *and"*

And change item ACED.1.(changed to ACFD.1. in NSTH 615.89) to:

"1. One or more layers, with a combined thickness of 25 cm or more, consisting of sapric materials below the surface tier; *and"*

Change item ACEH.(changed to ACFH. in NSTH 615.89) to:

"ACFH. Other Tropohemists that have one or more layers, with a combined thickness of 25 cm or more, consisting of fibric materials below the surface tier.
Fibric Tropohemists"

Change item ACEI. (changed to ACFI. in NSTH 615.89) to:

"ACFI. Other Tropohemists that have one or more layers, with a combined thickness of 25 cm or more, consisting of sapric materials below the surface tier.
Sapric Tropohemists"

Page 224 and NSTH 615.62 p. 615-287, definition of Typic Tropohemists change item 2. to read:

"2. Have:

a. Less than 25 cm consisting of fibric materials below the surface tier; *and*"

b. Less than 25 cm consisting of sapric materials below the surface tier;"

Change item ADBB.1.(changed to ADDB.1. in NSTH 615.89) to:

"1. One or more layers, with a combined thickness of 12.5 cm or more, consisting of fibric materials below the surface tier; *and*"

Change item ADBC.1.(changed to ADDC.1. in NSTH 615.89) to:

"1. One or more layers, with a combined thickness of 25 cm or more, consisting of hemic materials below the surface tier; *and*"

Hemic Terric Borosaprists"

Change item ADBG.(changed to ADDG. in NSTH 615.89) to:

"ADDG. Other Borosaprists that have one or more layers, with a combined thickness of 12.5 cm or more, consisting of fibric materials below the surface tier.

Fibric Borosaprists"

Change item ADBH.(changed to ADDH. in NSTH 615.89) to:

"ADDH. Other Borosaprists that have one or more layers, with a combined thickness of 25 cm or more, consisting of hemic materials below the surface tier.

Hemic Borosaprists"

Page 224 and NSTH 615.62 p. 615-288, definition of Typic Borosaprists change item 2. to read:

"2. Have:

a. Less than 12.5 cm consisting of fibric materials below the surface tier; *and*"

b. Less than 25 cm consisting of hemic materials below the surface tier;"

Page 226 and NSTH 615.62 p. 615-288 change item ADDB.1. (changed to ADFB.1. in NSTH 615.89) to:

"1. One or more layers, with a combined thickness of 12.5 cm or more, consisting of fibric materials below the surface tier; *and*"

Change item ADDC.1.(changed to ADFC.1. in NSTH 615.89) to:

"1. One or more layers, with a combined thickness of 25 cm or more, consisting of hemic materials below the surface tier; *and*"

Change item ADDG.(changed to ADFG. in NSTH 615.89) to:

"ADFG. Other Medisaprists that have one or more layers, with a combined thickness of 12.5 cm or more, consisting of fibric materials below the surface tier.

Fibric Medisaprists"

Change item ADDH.(changed to ADFH. in NSTH 615.89) to:

"ADFH. Other Medisaprists that have one or more layers, with a combined thickness of 25 cm or more, consisting of hemic materials below the surface tier.

Hemic Medisaprists"

Page 226 and NSTH 615.62 p. 615-289, definition of Typic Medisaprists change item 2. to read:

"2. Have:

a. Less than 12.5 cm consisting of fibric materials below the surface tier; *and*"

b. Less than 25 cm consisting of hemic materials below the surface tier;"

Page 226 and NSTH 615.62 p. 615-289 change item ACCB.1. (changed to ADEB.1. in NSTH 615.89) to:

"1. One or more layers, with a combined thickness of 12.5 cm or more, consisting of fibric materials below the surface tier; *and*"

Change item ADCC.1.(changed to ADEC.1. in NSTH 615.89) to:

"1. One or more layers, with a combined thickness of 12.5 cm or more, consisting of hemic materials below the surface tier; *and*"

Change item ADCG.(changed to ADEG. in NSTH 615.89) to:

"ADEG. Other Troposaprists that have one or more layers, with a combined thickness of 12.5 cm or more, consisting of fibric materials below the surface tier.

Fibric Troposaprists"

Change item ADCH.(changed to ADEH. in NSTH 615.89) to:

"ADEH. Other Troposaprists that have one or more layers, with a combined thickness of 25 cm or more, consisting of hemic materials below the surface tier.

Hemic Troposaprists"

Page 226 and NSTH 615.62 p. 615-289, definition of Typic Troposaprists change item 2. to read:

"2. Have:

a. Less than 12.5 cm consisting of fibric materials below the surface tier; *and*"

b. Less than 25 cm consisting of hemic materials below the surface tier;"

615.124 Redoximorphic Concentrations

Page 48 and NSTH 615.89 p. 615-425 Column 1 item 3. Redox concentrations change items (1) and (2) to read:

"(1) Nodules and concretions, ie., cemented bodies that can be removed from the soil intact. Concretions are distinguished from nodules on the basis of internal organization. A concretion typically has concentric layers that are visible to the naked eye. Nodules do not have visible organized internal structure. Boundaries commonly are diffuse if formed *in situ* and sharp after pedoturbation;

(2) Masses are noncemented concentrations of substances within the matrix; and"

615.125 Udollic Endoaqualfs

The Udollic subgroup was inadvertently omitted from Endoaqualfs in NSTH 615.89.

NSTH 615.89 p. 615-429 After Item IAJC. add:

"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, *one* of the following colors:

a. A hue of 7.5YR or redder in 50 percent or more of the matrix, *and*

(1) If peds are present, a chroma of 2 or more on 50 percent or more of ped exteriors, or no redox depletions with a chroma of 2 or less in ped interiors; *or*

(2) If peds are absent, a chroma of 2 or more in 50 percent or more of the matrix; *or*

b. In 50 percent or more of the matrix, a hue of 10YR or yellower *and either*

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

(2) A chroma of 2 or more if there are no redox concentrations.

Udollic Endoaqualfs"

And renumber items IAJD. through IAJG. to IAJE. through IAJH.

615.126 Addition of combination Vertic subgroups in the orders of Alfisols and Mollisols.

The vertic subgroup as revised in NSTH issue 16 captures many fine montmorillonitic Alfisols and Mollisols. Some of these soils were in Aeric, Aquic, Aquollic, Cumulic, Fluvaquentic, and Mollic, or Udollic subgroups. To preserve these unique taxa Aeric Vertic, Aeric Chromic Vertic, Aquertic, Aquertic Chromic, Chromic Vertic, Cumulic Vertic, Fluvaquentic Vertic, and Oxyaquic Vertic, subgroups are added to selected great groups. In addition the aeric criteria used in the Udollic Epiaqualf subgroup was inadvertently not updated the same in NSTH issue 16 as in the Aeric subgroup.

Page 110 and NSTH 615.61 p. 615-209 after item IAGA. add the following subgroups:

"IAGB. Other Albaqualfs 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 lithic or paralithic contact, whichever is shallower; *and*

2. A chroma of 3 or more in 40 percent or more of the matrix between the lower boundary of the A or Ap horizon and a depth of 75 cm from the mineral soil surface.

Aeric Vertic Albaqualfs

IAGC. Other Albaqualfs 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 lithic or paralithic contact, whichever is shallower; *and*

2. 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.

Chromic Vertic Albaqualfs"

And renumber items IAGB. through IAGH. to IAGD. through IAGJ.

NSTH 615.89 p. 615-429 before item IAIA. add items:

"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 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, *one* of the following colors:

a. A hue of 7.5YR or redder in 50 percent or more of the matrix, *and*

(1) If peds are present, a chroma of 2 or more on 50 percent or more of ped exteriors, or no redox depletions with a chroma of 2 or less in ped interiors; *or*

(2) If peds are absent, a chroma of 2 or more in 50 percent or more of the matrix; *or*

b. In 50 percent or more of the matrix, a hue of 10YR or yellower *and either*

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

(2) A chroma of 2 or more if there are 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 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, *one* of the following colors:

a. A hue of 7.5YR or redder in 50 percent or more of the matrix, *and*

(1) If peds are present, a chroma of 2 or more on 50 percent or more of ped exteriors, or no redox depletions with a chroma of 2 or less in ped interiors; *or*

(2) If peds are absent, a chroma of 2 or more in 50 percent or more of the matrix; *or*

b. In 50 percent or more of the matrix, a hue of 10YR or yellower *and either*

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

(2) A chroma of 2 or more if there are no redox concentrations.

Aeric Vertic Epiaqualfs

IAIC. 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 lithic or paralithic contact, whichever is shallower; *and*

2. 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.

Chromic Vertic Epiaqualfs"

And correct IAIF. (IAII.) as follows:

"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, *one* of the following colors:

a. A hue of 7.5YR or redder in 50 percent or more of the matrix, *and*

(1) If peds are present, a chroma of 2 or more on 50 percent or more of ped exteriors, or no redox depletions with a chroma of 2 or less in ped interiors; *or*

(2) If peds are absent, a chroma of 2 or more in 50 percent or more of the matrix; *or*

b. In 50 percent or more of the matrix, a hue of 10YR or yellower *and either*

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

(2) A chroma of 2 or more if there are no redox concentrations.

Udollic Epiaqualfs"

And add "Other" to item IAIA. and renumber items IAIA. through IAIE. to IAID. through IAIH. and items IAIG. through IAIJ. to IAIJ. through IAIM.

Page 130 and NSTH 615.61 p. 615-222 (revised 615.90 p. 615-517) add following IEKB. new subgroup IEKC., change subgroup IEKC. to IEKD., and add new subgroups IEKE. and IEKF.:

"IEKC. Other Hapludalfs which have *all* of the following:

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 cm or more between the mineral soil surface and either a depth of 100 cm or a 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 50 cm or more below the mineral soil surface; *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.

Aquertic Chromic Hapludalfs"

"IEKE. Other Hapludalfs that have *both*:

1. Saturation with water, in one or more layers within 100ácm of the mineral soil surface, for 1 month or more per year in 6 or more out of 10 years; *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 lithic or paralithic contact, whichever is shallower.

Oxyaquic Vertic Hapludalfs

IEKF. Other Hapludalfs 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 cm or more between the mineral soil surface and either a depth of 100 cm or a lithic or paralithic contact, whichever is shallower; *and*

2. 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.

Chromic Vertic Hapludalfs"

And renumber items IEKD. through IEKW. to IEKG. through IEKZ.

Page 139 and NSTH 615.90 p. 615-518. After item ICHA. add items ICHB. and ICHC.;

"ICHB. Other Haplustalfs 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 cm or more between the mineral soil surface and either a depth of 100 cm or a lithic or paralithic contact, whichever is shallower; *and*

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

Aquertic Haplustalfs

IHCC. Other Haplustalfs that 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 cm or more between the mineral soil surface and either a depth of 100 cm or a lithic or paralithic contact, whichever is shallower; *and*

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

Oxyaquic Vertic Haplustalfs"

And renumber items ICHB. through ICHO. to ICHD. through ICHQ.

Page 143 and NSTH 615.90 p. 615-519. Before item ICFA. add items ICFA. and ICFB.:

"ICHA. Paleustalfs 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 cm or more between the mineral soil surface and either a depth of 100 cm or a lithic or paralithic contact, whichever is shallower; *and*

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

Aquertic Paleustalfs

IHCB. Other Paleustalfs that 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 cm or more between the mineral soil surface and either a depth of 100 cm or a lithic or paralithic contact, whichever is shallower, saturation with water, in one or more layers within 100ácm of the mineral soil surface, for 1 month or more per year in 6 or more out of 10 years; *and*

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

Oxyaquic Vertic Paleustalfs"

And add "Other" to item ICFA. and renumber items ICFA. through ICFR. to ICFC. through ICFT.

NSTH 615.89 p. 615-489 and 490 after item HBGA. add:

"HBGB. Other Endoaquolls 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 cm or more between the mineral soil surface and either a depth of 100 cm or a lithic or paralithic contact, whichever is shallower; *and*

2. A mollic epipedon 60 cm or more thick.

Cumulic Vertic Endoaquolls

HBGC. Other Endoaquolls which have *all* of the following:

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 cm or more between the mineral soil surface and either a depth of 100 cm or a lithic or paralithic contact, whichever is shallower; *and*

2. *Either* 0.3 percent or more organic carbon in all horizons within 125 cm of 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 lithic or paralithic contact if shallower; *and*

3. A slope of less than 25 percent.

Fluvaquentic Vertic Endoaquolls"

And renumber items HBGB. through HBGI. to HBGD. through HBGK.

NSTH 615.89 p. 615-490 before item HBGA. add: items:

"HBFA. Epiaquolls that have *both* of the following:

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 cm or more between the mineral soil surface and either a depth of 100 cm or a lithic or paralithic contact, whichever is shallower; *and*

2. A mollic epipedon 60 cm or more thick.

Cumulic Vertic Epiaquolls

HBFB. Other Epiaquolls that have *all* of the following:

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 cm or more between the mineral soil surface and either a depth of 100 cm or a lithic or paralithic contact, whichever is shallower; *and*

2. *Either* 0.3 percent or more organic carbon in all horizons within 125 cm of 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 lithic or paralithic contact if shallower; *and*

3. A slope of less than 25 percent.

Fluvaquentic Vertic Epiaquolls"

And add word "Other" to item HBFA. and renumber items HBFA. through HBFH. to HBFC. through HBFJ.

Page 283 and NSTH 615.90 p. 615-535. Before item HEDF. add new item HDEG.;

"HDEF. Other Argiborolls 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 cm or more between the mineral soil surface and either a depth of 100 cm or a lithic or paralithic contact, whichever is shallower; *and*

2. 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).

Aquertic Argiborolls"

And renumber items HDEF. through HDET. to HDEG. through HDEU.

NSTH 615.90 p. 615-537. After item HGCB. add item HGCC.;

"HGCC. Other Argiudolls that 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 cm or more between the mineral soil surface and either a depth of 100 cm or a lithic or paralithic contact, whichever is shallower; *and*

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

Oxyaquic Vertic Argiudolls"

And renumber items HGCC. through HGCL. to HGCD. through HGCM.

615.127 Ultic subgroups of Andisols

The Alfic subgroups of Vitricryands, Haplustands, and Vitrixerands have no limits on base saturation in the argillic horizon. Ultic subgroups are being added. This will make the criteria consistent among the great groups and limit the base saturation (by sum of cations) to 35 percent or more in some part of the upper 50 cm of the argillic or kandic horizon in the alfic subgroups.

NSTH 615.60 p. 615-188 Column 1, after item BBEE. (changed to CBEE. NSTH 615.91 p. 615-573) Xeric Vitricryands add item:

"CBEF. Other Vitricryands which have an argillic or a kandic horizon that has *both*:

1. An upper boundary within 125 cm either of the mineral soil surface, or of the top of an organic layer with andic soil properties, whichever is shallower; *and*

2. A base saturation (by sum of cations) of less than 35 percent throughout the upper 50 cm or the entire argillic horizon, if it is less than 50 cm thick.

Ultic Vitricryands"

And renumber items CBEF. to CBEH. to CBEG. to CBEI.

NSTH 615.60 p. 615-199 Column 2. Add, after item BFBI. (changed to CFBI. NSTH 615.91 p. 615-573);

"CFBJ. Other Haplustands which have an argillic or a kandic horizon that has *both*:

1. An upper boundary within 125 cm either of the mineral soil surface, or of the top of an organic layer with andic soil properties, whichever is shallower; *and*

2. A base saturation (by sum of cations) of less than 35 percent throughout the upper 50 cm or the entire argillic horizon, if it is less than 50 cm thick.

Ultic Haplustands"

and renumber items CFBJ. through CFBL. to CFBK. to CFBL. through CFBM.

NSTH 615.60 p. 615-203 Column 1 Add, after item CDAC. Thaptic Vitrixerands add item:

"CDAD. Other Vitrixerands which have an argillic or a kandic horizon that has *both*:

1. An upper boundary within 125 cm either of the mineral soil surface, or of the top of an organic layer with andic soil properties, whichever is shallower; *and*

2. A base saturation (by sum of cations) of less than 35 percent throughout the upper 50 cm or the entire argillic horizon, if it is less than 50 cm thick.

Ultic Vitrixerands"

And renumber items CDAD. through CDAG. to CDAE. through CDAH. respectively.

615.128 Revisions to Entic and Torriorthentic subgroups of Mollisols

The criteria for these subgroups, with regard to the lower part of the mollic epipedon were unclear. The intent of these subgroups is to include soils that do not have a cambic horizon and that do not have part of the mollic epipedon in the position (below 25 cm) of a cambic horizon that fails to be a cambic horizon only because of color, unless either the cambic horizon or that part of the mollic epipedon below 25 cm is sandy or has free carbonates throughout.

Page 297 and NSTH 615.62 p. 615-330, left column, change item HGDJ. (changed to HGEM. in 615.84 and 615.89 p. 615-405 and 615-495) Entic Hapludolls to read:

"HGEM. Other Hapludolls that: *either*

1. Do not have a cambic horizon *and* do not, in any part of the mollic epipedon below 25 cm from the mineral soil surface, meet all the requirements for a cambic horizon except color; *or*

2. Have free carbonates throughout the cambic horizon *or* all parts of the mollic epipedon below a depth of 25 cm from the mineral soil surface.

Entic Hapludolls"

NSTH 615.62 p. 615-330, definition of Typic Hapludolls, replace item 4. with the following:

"4. Have a cambic horizon that does not have free carbonates throughout, *or* have in some part of the mollic epipedon, below 25 cm from the mineral soil surface, all of the requirements for a cambic horizon except color, *and* no free carbonates;

Page 304 and NSTH 615.62 p. 615-339, column 1 change item HFGR. 2. (changed to HFGS. 2. in 615.106 and 615.89 p. 615-601 and 615-495) Torriorthentic Haplustolls to read:

"2. *Either*:

1. Do not have a cambic horizon *and* do not, in any part of the mollic epipedon below 25 cm from the mineral soil surface, meet all the requirements for a cambic horizon except color; *or*

2. Have free carbonates throughout the cambic horizon *or* all parts of the mollic epipedon below a depth of 25 cm from the mineral soil surface.

Torriorthentic Haplustolls"

Page 304 and NSTH 615.62 p. 615-339, column 2 change item GEGX. (changed to HFGY. in 615.106 and 615.89 p. 615-601 and 615-495) Entic Haplustolls to read:

"HFGY. Other Haplustolls that: *either*

1. Do not have a cambic horizon *and* do not, in any part of the mollic epipedon below 25 cm from the mineral soil surface, meet all the requirements for a cambic horizon except color; *or*

2. Have free carbonates throughout the cambic horizon *or* all parts of the mollic epipedon below a depth of 25 cm from the mineral soil surface.

Entic Haplustolls"

Page 304 and NSTH 615.62 p. 615-340, definition of Typic Haplustolls, replace item 4. with the following:

"4. Have a cambic horizon that does not have free carbonates throughout, *or* have in some part of the mollic epipedon, below 25 cm from the mineral soil surface, all of the requirements for a cambic horizon except color, *and* no free carbonates;

NSTH 615.62 p. 615-350, column 1 change item HDFT. 2. (changed to HDFU. 2. in 615.89 p. 615-499) Torriorthentic Haploxerolls to read:

"2. *Either*:

1. Do not have a cambic horizon *and* do not, in any part of the mollic epipedon below 25 cm from the mineral soil surface, meet all the requirements for a cambic horizon except color; *or*

2. Have free carbonates throughout the cambic horizon *or* all parts of the mollic epipedon below a depth of 25 cm from the mineral soil surface.

Torriorthentic Haploxerolls"

Page 316 and NSTH 615.62 p. 615-350, column 2 change item HDFZb. (changed to HDFZc. in 615.89 p. 615-499) Entic Haploxerolls to read:

"HDFZc. Other Haploxerolls that: *either*

1. Do not have a cambic horizon *and* do not, in any part of the mollic epipedon below 25 cm from the mineral soil surface, meet the requirements for a cambic horizon except color; *or*

2. Have free carbonates throughout the cambic horizon *or* all parts of the mollic epipedon below a depth of 25 cm from the mineral soil surface.

Entic Haploxerolls"

Page 317 and NSTH 615.62 p. 615-350, definition of Typic Haploxerolls, replace item 5. with the following:

"5. Have a cambic horizon that does not have free carbonates throughout, *or* have in some part of the mollic epipedon, below 25 cm from the mineral soil surface, all of the requirements for a cambic horizon except color, *and* no free carbonates;

615.129 Aquic Cumulic subgroups of Mollisols

The cumulic subgroup of Cryoborolls, Haploborolls, Hapludolls, Haplustolls, and Haploxerolls included both soils with and without aquic conditions within 75 cm of the mineral soil surface. An "Aquic Cumulic" subgroup is added to all of the great groups of Mollisols that have a cumulic subgroup because this subgroup will help in making soil interpretations.

The following changes are needed to implement this proposal:

Page 286 and NSTH 615.62 p. 615-321 following item HEBM. (changed to HEBN) Add:

"HEBO. Other Cryoborolls which have:

1. A mollic epipedon 40 cm or more thick with a texture finer than loamy fine sand; *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 lithic or paralithic contact if shallower; *and*

3. A slope of less than 25 percent; *and*

4. In one or more horizons within 100 cm of the mineral soil surface, distinct or prominent redox concentrations, and also aquic conditions for some time in most years (or artificial drainage).

Aquic Cumulic Cryoborolls"

And renumber items HEBO. through HEBZa. to HEBP. through HEBZb.

Page 289 and NSTH 615.62 p. 615-323 following item HEGG. add:

"HEGH. Other Haploborolls which have:

1. A mollic epipedon 40 cm or more thick, of which less than 50 percent has a sandy particle size, and no paralithic contact or 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 lithic or paralithic contact if shallower; *and*

3. A slope of less than 25 percent; *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 Haploborolls"

And renumber items HEGH. through HEGV. to HEGI. through HEGW.;

Page 296 and 297 and NSTH 615.62 p. 615-329 following HGDD. (changed to HGEE.) add:

"HGEF. Other Hapludolls which have:

1. A mollic epipedon 60 cm or more thick with 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 lithic or paralithic contact if shallower; *and*

3. A slope of 25 percent or less; *and*

4. Within 40 cm of the mineral soil surface, in horizons that also have redoximorphic features; *or*

5. Directly below the mollic epipedon, in one or more horizons with a total thickness of 15 cm or more that have *one or more* of the following:

a. A color value, moist, of 4 or more and redox depletions with a chroma of 2 or less; *or*

b. A hue of 10YR or redder and a chroma of 2 or less; *or*

c. A hue of 2.5Y or yellower and a chroma of 3 or less.

Aquic Cumulic Hapludolls"

And renumber items HGEF. through HGEN. to HGEG. through HGEO.;

Page 304 and NSTH 615.62 p. 615-338 following HFGL. (changed to HFGK.) add:

"HFGL. Other Haplustolls which have:

1. A mollic epipedon 50 cm or more thick with a texture finer than loamy fine sand; *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 lithic or paralithic contact if shallower; *and*

3. A slope of less than 25 percent; *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 Haplustolls"

And renumber items HFGL. through HFGZ. to HFGH. through HFGZa.

Page 316 and 317 and NSTH 615.62 p. 615-329 following HDFG. (changed to HDFF.) add:

"HDFG. Other Haploxerolls which have:

1. A mollic epipedon 50 cm or more thick with a texture finer than loamy fine sand; *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 lithic or paralithic contact if shallower; *and*

3. A slope of less than 25 percent; *and*

4. 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).

Aquic Cumulic Haploxerolls"

And renumber items HDFG. through HDFZd. to HDFH. through HDFZe.

615.130 Xeric Duraquerts

Duraquerts with a xeric moisture regime are known to occur in California. No xeric subgroup was provided in NSTH 615.90. These soils currently key as Ustic Duraquerts. Xeric Duraquerts are added to improve the way Duraquerts are grouped at the subgroup level.

NSTH 615.90 p. 615-551 column 1 after EABA. add:

"EABB. Other Duraquerts which have a thermic, mesic, or frigid soil temperature regime and which, if not irrigated during the year, have cracks in 6 or more out of 10 years that remain *both*:

1. Five mm or more wide, through a thickness of 25 cm or more within 50 cm of the mineral soil surface, for 60 or more consecutive days during the 90 days following the summer solstice; *and*

2. Closed for 60 or more consecutive days during the 90 days following the winter solstice.

Xeric Duraquerts"

And renumber items EABB. through EABE. to EABC. through EABF.

NSTH 615.90 p. 615-551 column 2, Definition of Typic Duraquerts after item 3. add:

4. Do not have both a thermic, mesic, or frigid soil temperature regime and, if not irrigated during the year, have cracks in 6 or more out of 10 years that remain *both*:

a. Five mm or more wide, through a thickness of 25 cm or more within 50 cm of the mineral soil surface, for 60 or more consecutive days during the 90 days following the summer solstice; *and*

b. Closed for 60 or more consecutive days during the 90 days following the winter solstice.

615.131 Lithic Endoaquods

No lithic subgroup was provided in Endoaquods. Aquods with a water table perched on a lithic contact are Endoaquods. A lithic subgroup is added to Endoaquods.

NSTH 615.91 p. 615-581 Before item BAGA. add:

"BAGA. Endoaquods that have a lithic contact within 50 cm of the mineral soil surface.
Lithic Endoaquods"

Add "Other" at the beginning of BAGA. and renumber items BAGA. through BAGE. to BAGB. through BAGF.

NSTH 615.91 p. 615-581 Definition of Typic Endoaquods After item 3. add:

4. Do not have a lithic contact within 50 cm of the mineral soil surface.

615.132 Entic and Aquentic subgroups of Fragiorthods and Haplorthods

The former Entic Fragiorthod and Entic Haplorthod criteria were difficult to follow and also used particle-size classes which are difficult to determine in Spodosols.

NSTH 615.91 p. 615-589 Change item BDCF. to read:

"BDCF. Other Fragiorthods which have a spodic horizon that has *one* of the following:

1. A texture of very fine sand, loamy very fine sand, or finer: *and*

a. A thickness of 10ácm or less; *and*

b. A weighted average of less than 1.2ápercent organic carbon; *and*

c. Within the upper 7.5ácm, either or both a moist color value or chroma of 4 or more (crushed and smoothed sample); *or*

2. A texture of loamy fine sand, fine sand, or coarser *and either or both*, a moist color value *or* chroma of 4 or more (crushed and smoothed sample) in the upper 2.5ácm.
Entic Fragiorthods"

NSTH 615.91 p. 615-589 definition of Typic Fragiorthods change item 5. to read:

5. Have a spodic horizon that has *one or more* of the following:

a. A texture of very fine sand, loamy very fine sand, or finer: *and*

(1) A thickness of more than 10ácm; *or*

(2) A weighted average of 1.2ápercent or more organic carbon; *or*

(3) Within the upper 7.5ácm, either or both a moist color value or chroma of 3 or less (crushed and smoothed sample); *or*

b. A texture of loamy fine sand, fine sand, or coarser *and both*, a moist color value *and* chroma of 3 or less (crushed and smoothed sample) in the upper 2.5ácm.

NSTH 615.91 p. 615-589 Change item BDEA. to read:

"BDEA. Haplorthods which have a lithic contact within 50 cm of the mineral soil surface; *and either*

1. A spodic horizon with a texture of very fine sand, loamy very fine sand, or finer: *and*

a. A thickness of 10ácm or less; *and*

b. A weighted average of less than 1.2ápercent organic carbon; *and*

c. Within the upper 7.5ácm, *either or both* a moist color value *or* chroma of 4 or more (crushed and smoothed sample); *or*

2. A spodic horizon with a texture of loamy fine sand, fine sand, or coarser *and either or both*, a moist color value *or* chroma of 4 or more (crushed and smoothed sample) in the upper 2.5ácm.
Entic Lithic Haplorthods"

NSTH 615.91 p. 615-590. Change item BDED. to read:

"BDED. Other Haplorthods which have 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); *and either*

1. A spodic horizon that has a texture of very fine sand, loamy very fine sand, or finer: *and*

a. A thickness of 10ácm or less; *and*

b. A weighted average of less than 1.2ápercent organic carbon; *and*

c. Within the upper 7.5ácm, *either or both* a moist color value *or* chroma of 4 or more (crushed and smoothed sample); *or*

2. A spodic horizon that has a texture of loamy fine sand, fine sand, or coarser *and either or both*, a moist color value *or* chroma of 4 or more (crushed and smoothed sample) in the upper 2.5ácm.
Aquentic Haplorthods"

NSTH 615.91 p. 615-590 Change item BDEJ. to read:

"BDEJ. Other Haplorthods which have a spodic horizon that has *one* of the following:

1. A texture of very fine sand, loamy very fine sand, or finer: *and*

a. A thickness of 10ácm or less; *and*

b. A weighted average of less than 1.2ápercent organic carbon; *and*

c. Within the upper 7.5ácm, *either or both* a moist color value *or* chroma of 4 or more (crushed and smoothed sample); *or*

2. A texture of loamy fine sand, fine sand, or coarser and *either or both*, a moist color value *or* chroma of 4 or more (crushed and smoothed sample) in the upper 2.5ácm.

Entic Haplorthods"

NSTH 615.91 p. 615-589 definition of Typic Haplorthods change item 6. to read:

6. Have a spodic horizon that has *one or more* of the following:

a. A texture of very fine sand, loamy very fine sand, or finer: *and*

(1) A thickness of more than 10ácm; *or*

(2). A weighted average of 1.2ápercent or more organic carbon; *or*

(3) Within the upper 7.5ácm, either or both a moist color value or chroma of 3 or less (crushed and smoothed sample); *or*

b. A texture of loamy fine sand, fine sand, or coarser *and both*, a moist color value *and* chroma of 3 or less (crushed and smoothed sample) in the upper 2.5ácm.

615.133 Key to the Orders and suborders of Histosols

The following changes are made to solve problems in the key to the suborders of Histosols. Using the former version of the Key some Histosols which are never saturated with water except for a few days following heavy rains classify as Saprists. Also the wording of the last phrase of item A.2.a. in the Key to the Orders could be interpreted to include layers of fragmental materials or of organic materials greater than 40 cm thick. The intent is to only include soils that have both an organic layer and a fragmental layer.

Page 92, Key to orders item A.2.a. (refer to NSTH 615.91). Change items A.2.a. and A.2.b. to read:

"A. Soils which:

1. Do not have andic soil properties in 60 percent or more of the thickness between the soil surface and either a depth of 60 cm, or a lithic or paralithic contact or duripan if shallower; *and*

2. Have organic soil materials that meet *one or more* of the following:

a. Overlie cindery, fragmental, or pumiceous materials and/or fill their interstices[1], *and* directly below these materials either a lithic or paralithic contact; *or*

b. When added with underlying cindery, fragmental, or pumiceous materials total 40 cm or more between the soil surface and a depth of 50 cm; *or*

c. Constitute two thirds or more of the total thickness of the soil to a lithic or paralithic contact *and* mineral soil layers which, if present, have a total thickness of 10 cm or less; *or*

d. Are saturated with water for 6 months or more per year in most years (or artificially drained), and have an upper boundary within 40 cm of the soil surface, and have a total thickness of *either*:

(1) 60 cm or more if three fourths or more of the volume consists of moss fibers, *or* if the bulk density, moist, is less than 0.1 g/cm^3; *or*

(2) 40 cm or more if they consist either of sapric or hemic materials, or of fibric materials with less than three fourths (by volume) moss fibers *and* a bulk density, moist, of 0.1 g/cm^3 or more.

Histosols, p.

Page 212, column 1 Replace entire key to suborders with:

"KEY TO SUBORDERS

AA. Histosols which are never saturated with water except for a few days following heavy rains, *and* which have *both*:

1. A lithic or paralithic contact within 100 cm of the soil surface, *and/or* a thickness of organic plus cindery, fragmental, or pumiceous materials totaling 40 cm or more between the soil surface and a depth of 50 cm; *and*

2. Organic soil materials, that are, by weighted average, less than three fourths (by volume) *Sphagnum* fibers.

Folists, p.

AB. Other Histosols which *either*:

1. Have more thickness of fibric soil materials than any other kind of organic soil material; *either*

a. In the organic parts of the subsurface tier if there is no continuous mineral layer 40 cm or more thick that has its upper boundary within the subsurface tier; *or*

b. In the *combined* thickness of the organic parts of the surface *and* subsurface tiers *if* there is a continuous mineral layer 40 cm or more thick that has its upper boundary within the subsurface tier; *or*

2. Are organic soil materials, that are, by weighted average, three fourths or more by volume, *Sphagnum* fibers and which rest on a lithic or paralithic contact, fragmental materials, or on organic materials frozen 2 months after the summer solstice.

Fibrists, p.

AC. Other Histosols that have more thickness of hemic soil materials than any other kind of organic soil materials *either*:

1. In the organic parts of the subsurface tier *if* there is no continuous mineral layer 40 cm or more thick that has its upper boundary within the subsurface tier; *or*

2. In the *combined* thickness of the organic parts of the surface *and* subsurface tiers if there is a continuous mineral layer 40 cm or more thick that has its upper boundary within the subsurface tier.

Hemists, p.

AD. Other Histosols.

Saprists, p."

615.134 Family differentiae for Histosols

Page 390 right column delete entire section "Soil depth classes" and insert the following:

"**Soil depth classes**

Soil depth classes refer to the depth to a lithic, paralithic, or petroferric contact, or to cindery,

[1] Materials that meet the definition of cindery, fragmental, or pumiceous except have more than 10 percent (by volume) voids that are filled with organic soil materials are considered as organic soil materials.

fragmental, or pumiceous material. The following two soil depth modifiers are used for families in all subgroups of Histosols, except that the shallow class is not used in the suborder of Folists:

Shallow.--Between 18 and 50 cm from the soil surface.

Micro.--At a depth less than 18 cm from the soil surface."

615.135 Addition of Typic Subgroups

Page 111, second column, following the paragraph on Duraqualfs add:

"Key to subgroups
IABA. All Duraqualfs (provisionally).
Typic Duraqualfs"

Page 117, second column, following the definition of Plinthaqualfs add:

"Key to subgroups
IAAA. All Plinthaqualfs (provisionally).
Typic Plinthaqualfs"

Page 124, first column, following the paragraph on Natriboralfs add:

"Key to subgroups
IBCA. All Natriboralfs (provisionally).
Typic Natriboralfs"

Page 125, second column, following the paragraphs on Agrudalfs add:

"Key to subgroups
IEAA. All Agrudalfs (provisionally).
Typic Agrudalfs"

Page 136, first column, following the paragraph on Rhodudalfs add:

"Key to subgroups
IEJA. All Rhodudalfs (provisionally).
Typic Rhodudalfs"

Page 138, first column, following the paragraph on Durustalfs add:

"Key to subgroups
ICAA. All Durustalfs (provisionally).
Typic Durustalfs"

Page 145, second column, following the paragraph on Plinthustalfs add:

"Key to subgroups
ICBA. All Plinthustalfs (provisionally).
Typic Plinthustalfs"

Page 153, first column, following the paragraph on Plinthoxeralfs add:

"Key to subgroups
IDDA. All Plinthoxeralfs (provisionally).
Typic Plinthoxeralfs"

Page 214, second column, following the paragraph on Luvifibrists add:

"Key to subgroups
ABEA. All Luvifibrists (provisionally).
Typic Luvifibrists"

Page 221, second column, following the paragraph on Luvihemists add:

"Key to subgroups
ACCA. All Luvihemists (provisionally).
Typic Luvihemists"

Page 245, first column, following the paragraph on Plinthaquepts add:

"Key to subgroups
JAFA. All Plinthaquepts (provisionally).
Typic Plinthaquepts"

Page 257, second column, following the paragraph on Plaggepts add:

"Key to subgroups
JBA. All Plaggepts (provisionally).
Typic Plaggepts"

Page 262, second column, following the paragraph on Sombritropepts add:

"Key to subgroups
JCBA. All Sombritropepts (provisionally).
Typic Sombritropepts"

Page 358, second column, following the paragraph on Plinthohumults add:

"Key to subgroups
GBBA. All Plinthohumults (provisionally).
Typic Plinthohumults"

Page 358, second column, following the paragraph on Sombrihumults add:

"Key to subgroups
GBAA. All Sombrihumults (provisionally).
Typic Sombrihumults"

Page 366, second column, following the definition of Plinthudults add:

"Key to subgroups
GCBA. All Plinthudults (provisionally).
Typic Plinthudults"

Page 371, second column, following the paragraph on Plinthustults add:

"Key to subgroups
GDAA. All Plinthustults (provisionally).
Typic Plinthustults"

Page 373, second column, following the definition of Palexerults add:

"Key to subgroups
GEAA. All Palexerults (provisionally).
Typic Palexerults"

615.136 Table 7, additions and deletions

The following changes required in table 7 result from implementing the recommendations from International Committee on Aridisols, (ICOMID).

Page 86 Table 7. Delete the suborder "Orthids" and all great groups of Orthids; and delete the following great groups of Argids; "Durargids" and "Nadurargids".

Add the following suborders and great groups in the order Aridisols:

Before Haplargids add:
"Calciargids
Gypsiargids"
And following Paleargids add:
Petroargids
Following Argids add:
"Calcids
Haplocalcids
Petrocalcids
Cambids
Anthracambids
Aquicambids
Haplocambids
Petrocambids

Cryids
Argicryids
Calcicryids
Gypsicryids
Haplocryids
Petrocryids
Salicryids
Durids
Argidurids
Haplodurids
Natridurids
Gypsids
Argigypsids
Calcigypsids
Haplogypsids
Natrigypsids
Petrogypsids
Salids
Aquisalids
Haplosalids"

615.137 Corrections and clarifications

NSTH 615.89 p. 615-427 (and p. 96 and 109) item IA. 1.b: "chroma or 2" should be "chroma of 2"

NSTH 615.89 p. 615-449 item BAFA. (changed to CAFA. in NSTH 615.91) delete word "Other"

The criteria for vitric subgroups of Andisols should have used both dried and undried 1500 kPa water content. The dried content was inadvertently omitted in the NSTH 615.60 and the word "or" was omitted between "25 cm" and "more".

NSTH 615.60 p. 615-176 left column Andic Soil Properties, delete footnote 2/ and insert text of the footnote into the description of Andic Soil Properties.

615.60 p. 615-206 delete the terms "glass aggregates, glass-coated grains, and other vitric volcaniclastics" from the definition of "ashy".

NSTH 615.60 p. 615-185 item BBCB. (changed to CBCB. in NSTH 615.91). replace the first 4 lines of the criteria with the following:

"CBCB. Other Fulvicryands that have 1500 kPa water retention of less than 15 percent on air-dried samples *or* of less than 30 percent on undried samples throughout one or more layers with andic soil properties that have a total thickness of 25 cm or more within 100 cm"

NSTH 615.60 p. 615-186 item BBFE. (changed to CBFE. in NSTH 615.91). replace the first 4 lines of the criteria with the following:

"CBFE. Other Haplocryands that have 1500 kPa water retention of less than 15 percent on air-dried samples *or* of less than 30 percent on undried samples throughout one or more layers with andic soil properties that have a total thickness of 25 cm or more within 100 cm"

NSTH 615.60 p. 615-187 item BBBC. (changed to CBBC. in NSTH 615.91). replace the first 4 lines of the criteria with the following:

"CBBC. Other Melanocryands that have 1500 kPa water retention of less than 15 percent on air-dried samples *or* of less than 30 percent on undried samples throughout one or more layers with andic soil properties that have a total thickness of 25 cm or more within 100 cm"

NSTH 615.60 p. 615-192 item BGFK. (changed to CGFL. in NSTH 615.91). replace the first 4 lines of the criteria with the following:

"CGFL. Other Hapludands that have 1500 kPa water retention of less than 15 percent on air-dried samples *or* of less than 30 percent on undried samples throughout one or more layers with andic soil properties that have a total thickness of 25 cm or more within 100 cm either of"

NSTH 615.60 p. 615-195 item BGCG. (changed to CGCH. in NSTH 615.91). replace the first 4 lines of the criteria in item 2. with the following:

"2. A 1500 kPa water retention of less than 15 percent on air-dried samples *or* of less than 30 percent on undried samples throughout one or more layers with andic soil properties that have a total thickness of 25 cm or more within 100 cm either of"

NSTH 615.60 p. 615-196 item BGCJ. (changed to CGCK. in NSTH 615.91). replace the first 4 lines of the criteria in item 2. with the following:

"2. A 1500 kPa water retention of less than 15 percent on air-dried samples *or* of less than 30 percent on undried samples throughout one or more layers with andic soil properties that have a total thickness of 25 cm or more within 100 cm either of"

NSTH 615.60 p. 615-195 item BGCK. (changed to CGCL. in NSTH 615.91). replace the first 4 lines of the criteria in item 2. with the following:

"2. A 1500 kPa water retention of less than 15 percent on air-dried samples *or* of less than 30 percent on undried samples throughout one or more layers with andic soil properties that have a total thickness of 25 cm or more within 100 cm either of"

NSTH 615.60 p. 615-196 item BGCL. (changed to CGCM. in NSTH 615.91 and name corrected). replace the first 4 lines with the following:

"CGCM. Other Melanudands which have 1500 kPa water retention of less than 15 percent on air-dried samples *or* of less than 30 percent on undried samples throughout one or more layers with andic soil properties that have a total thickness of 25 cm or more within 100 cm"

NSTH 615.60 p. 615-197 item BGAE. (changed to CGAE. in NSTH 615.91). replace the first 4 lines of the criteria in item 2. with the following:

"2. A 1500 kPa water retention of less than 15 percent on air-dried samples *or* of less than 30 percent on undried samples throughout one or more layers with andic soil properties that have a total thickness of 25 cm or more within 100 cm either of"

NSTH 615.60 p. 615-196 item BGAF. (changed to CGAF. in NSTH 615.91) replace the first 4 lines with the following:

"CGAF. Other Placudands which have 1500 kPa water retention of less than 15 percent on air-dried samples *or* of less than 30 percent on undried samples throughout one or more layers with andic soil properties that have a total thickness of 25 cm or more within 100 cm either of"

NSTH 615.60 p. 615-199 item BFBC. (changed to CFBC. in NSTH 615.91) replace the first 4 lines of the criteria in item 2. with the following:

"2. A 1500 kPa water retention of less than 15 percent on air-dried samples *or* of less than 30 percent on undried samples throughout one or more layers with andic soil properties that have a total thickness of 25 cm or more within 100 cm either of"

NSTH 615.60 p. 615-199 item BFBD. (changed to CFBD. in NSTH 615.91) replace the first 4 lines with the following:

"CFBD. Other Haplustands which have 1500 kPa water retention of less than 15 percent on air-dried samples *or* of less than 30 percent on undried samples throughout one or more layers with andic soil properties that have a

total thickness of 25 cm or more within 100 cm either of"

NSTH 615.45 p. 615-123 item CC. (changed to DC. in NSTH 615.60) Correct to read:

"DC. Other Oxisols that have an ustic or xeric moisture regime.

Ustox p. 432"

NSTH 615.91 p. 615-587 correct item "BDDD. Grossarenic Entic Alorthods" to "BDDD. Entic Grossarenic Alorthods" by our naming conventions multiple subgroup names are in alphabetical order.

NSTH 615.89 p 615-508 item GAHD. "Epiaquults" should be "Other Epiaquults"

NSTH 615.90 p 615-564 item EEED. Petrocalcic Haplusterts; correct "100 cm" to "150 cm".

The criteria for Dystric Eutrochrepts and the Dystric part of the Aquic Dystric Eutrochrepts and Dystric Fluventic Eutrochrepts subgroups have been changed inadvertently by the reformatting of the subgroups. The original criterion from Soil Taxonomy page 251 is the inverse of "d. Have carbonates within a depth of 1 meter in some part of each pedon;"

Page 251 and NSTH 615.62 p. 615-300 item JDFG.2. (changed to JDGH.2. in NSTH 615.89, p. 615-481): correct to read:

"2. Do not have free carbonates throughout any horizon within 100 cm of the mineral soil surface; *and*"

Page 251 and NSTH 615.62 p. 615-300 item JDFI.1. (changed to JDGK.1. in NSTH 615.89, p. 615-481): correct to read:

"1. Do not have free carbonates throughout any horizon within 100 cm of the mineral soil surface; *and*"

Page 251 and NSTH 615.62 p. 615-300 item JDFL. (changed to JDGN. in NSTH 615.89, p. 615-481): correct to read:

"JDGN. Other Eutrochrepts that do not have free carbonates throughout any horizon within 100 cm of the mineral soil surface."

Page 218 and NSTH 615.100 p. 615-597 and Soil Taxonomy p. 218; When the "Key to great groups" of Folists was amended adding "Medifolists" item AAB. should have been amended as follows:

"AAB. Other Folists that have an isomesic or warmer *iso* temperature regime."

When the criteria for some "aquic" suborders were written they were constructed in such a manner that soils with a lithic or paralithic contact at a depth of less than 40 cm below the mineral soil could not be met. The intent of the criteria are to include such soils in "aquic" suborders, but to exclude deeper soils that have aquic conditions only in layers above a depth of 40 cm.

The following are needed to correct this error:

NSTH 615.89 p. 615-448 item BA.2. (changed to CA.2. in NSTH 615.91) replace the first paragraph with the following:

2. In a layer above a lithic or paralithic contact or in a layer between 40 and 50 cm either from the mineral soil surface or from the top of an organic layer with andic soil properties, whichever is shallowest, aquic conditions for some time in most years (or artificial drainage) *and one or more* of the following:

NSTH 615.89 p. 615-448 Aquands, definition item 2. Replace the first paragraph with the following:

2. In a layer above a lithic or paralithic contact or in a layer between 40 and 50 cm either from the mineral soil surface or from the top of an organic layer with andic soil properties, whichever is shallowest, aquic conditions for some time in most years (or artificial drainage) *and one or more* of the following:

NSTH 615.89 p. 615-460 item KA.3. replace the first paragraph with the following:

3. In a layer above a lithic or paralithic contact or in a layer between 40 and 50 cm from the mineral soil surface, whichever is shallower, aquic conditions for some time in most years (or artificial drainage) *and one or more* of the following:

NSTH 615.89 p. 615-461 Aquents, definition item 3. Replace the first paragraph with the following:

3. In a layer above a lithic or paralithic contact or in a layer between 40 and 50 cm from the mineral soil surface, whichever is shallower, aquic conditions for some time in most years (or artificial drainage) *and one or more* of the following:

NSTH 615.89 p. 615-474 item JA.1. replace the first paragraph with the following:

1. In a layer above a lithic or paralithic contact or in a layer between 40 and 50 cm from the mineral soil surface, whichever is shallower, aquic conditions for some time in most years (or artificial drainage) *and one or more* of the following:

NSTH 615.89 p. 615-475 Aquepts, definition item 1. Replace the first paragraph with the following:

2. In a layer above a lithic or paralithic contact or in a layer between 40 and 50 cm from the mineral soil surface, whichever is shallower, aquic conditions for some time in most years (or artificial drainage) *and one or more* of the following:

NSTH 615.89 p. 615-486 item HB. replace the first paragraph with the following:

1. Other Mollisols that have in a layer above a lithic or paralithic contact or in a layer between 40 and 50 cm from the mineral soil surface, whichever is shallower, aquic conditions for some time in most years (or artificial drainage) *and one or more* of the following:

NSTH 615.89 p. 615-475 Aquolls, definition, Replace the first paragraph with the following:

2. Aquolls are the Mollisols that have in a layer above a lithic or paralithic contact or in a layer between 40 and 50 cm from the mineral soil surface, whichever is shallower, aquic conditions for some time in most years (or artificial drainage) *and one or more* of the following:

The Key to the orders was changed in NSTH 615.91. Soils with a thickness of less than 35 cm of andic soil materials are keyed into the order of Andisols if the thickness of andic soil materials is more than 60 percent of the thickness between either the mineral soil surface or the top of an organic layer with andic soil properties, whichever is shallower, and a lithic or paralithic contact, duripan or petrocalcic horizon. When this change was made no provisions were made to allow these thin Andisols into the suborder of Vitrands and some great groups of Cryands, Xerands, and Udands. To correct this omission the following changes are needed.

NSTH 615.60 p. 615-180 change item BE. (Changed to CE. in NSTH 615.91) to the following:

"CE. Other Andisols that have a 1500-kPa water retention of less than 15 percent on air-dried samples *and* of less than 30 percent on undried samples, throughout 60 percent or more of the thickness *either*:

1. Within 60 cm either of the mineral soil surface, or of the top of an organic layer with andic soil

properties, whichever is shallower, if there is no lithic or paralithic contact, duripan, or petrocalcic horizon within that depth; *or*

2. Between either the mineral soil surface, or the top of an organic layer with andic soil properties, whichever is shallower, and a lithic or paralithic contact, duripan, or petrocalcic horizon.

Vitrands"

NSTH 615.60 p. 615-181 change item BAD. (Changed to CAD. in NSTH 615.91) to the following:

"CAD. Other Aquands that have a 1500-kPa water retention of less than 15 percent on air-dried samples *and* of less than 30 percent on undried samples, throughout 60 percent or more of the thickness *either*:

1. Within 60 cm either of the mineral soil surface, or of the top of an organic layer with andic soil properties, whichever is shallower, if there is no lithic or paralithic contact, duripan, or petrocalcic horizon within that depth; *or*

2. Between either the mineral soil surface, or the top of an organic layer with andic soil properties, whichever is shallower, and a lithic or paralithic contact, duripan, or petrocalcic horizon.

Vitraquands"

NSTH 615.60 p. 615-184 Definition of Vitraquands, change item 1. to the following:

"1. Have a 1500-kPa water retention of less than 15 percent on air-dried samples *and* of less than 30 percent on undried samples, throughout 60 percent or more of the thickness *either*:

a. Within 60 cm either of the mineral soil surface, or of the top of an organic layer with andic soil properties, whichever is shallower, if there is no lithic or paralithic contact, duripan, or petrocalcic horizon within that depth; *or*

b. Between either the mineral soil surface, or the top of an organic layer with andic soil properties, whichever is shallower, and a lithic or paralithic contact, duripan, or petrocalcic horizon."

NSTH 615.60 p. 615-185 change item BBD. and BBE.. (Changed to CBD. and CBE. in NSTH 615.91) to the following:

"CBD. Other Cryands that have, undried, a 1500-kPa water retention of 100 percent or more, on the weighted average, throughout *either*:

1. One or more layers with a total thickness of 35 cm between the mineral soil surface, or of the top of an organic layer with andic soil properties, whichever is shallower, and 100 cm from the mineral soil surface, or of the top of an organic layer with andic soil properties, whichever is shallower, if there is no lithic or paralithic contact, duripan, or petrocalcic horizon within that depth; *or*

2. 60 percent or more of the thickness between either the mineral soil surface, or the top of an organic layer with andic soil properties, whichever is shallower, and a lithic or paralithic contact, duripan, or petrocalcic horizon.

Hydrocryands

CBE. Other Cryands that have a 1500-kPa water retention of less than 15 percent on air-dried samples *and* of less than 30 percent on undried samples, throughout 60 percent or more of the thickness *either*:

1. Within 60 cm either of the mineral soil surface, or of the top of an organic layer with andic soil properties, whichever is shallower, if there is no lithic or paralithic contact, duripan, or petrocalcic horizon within that depth; *or*

2. Between either the mineral soil surface, or the top of an organic layer with andic soil properties, whichever is shallower, and a lithic or paralithic contact, duripan, or petrocalcic horizon.

Vitricryands"

NSTH 615.60 p. 615-186 Definition of Hydrocryands, change item 3. to the following:

"3. Have, undried, a 1500-kPa water retention of 100 percent or more, on the weighted average, throughout *either*:

a. One or more layers with a total thickness of 35 cm between the mineral soil surface, or of the top of an organic layer with andic soil properties, whichever is shallower, and 100 cm from the mineral soil surface, or of the top of an organic layer with andic soil properties, whichever is shallower, if there is no lithic or paralithic contact, duripan, or petrocalcic horizon within that depth; *or*

b. 60 percent or more of the thickness between either the mineral soil surface, or the top of an organic layer with andic soil properties, whichever is shallower, and a lithic or paralithic contact, duripan, or petrocalcic horizon.

NSTH 615.60 p. 615-187 Definition of Vitricryands, change item 3. to the following:

"3. Have a 1500-kPa water retention of less than 15 percent on air-dried samples *and* of less than 30 percent on undried samples, throughout 60 percent or more of the thickness *either*:

a. Within 60 cm either of the mineral soil surface, or of the top of an organic layer with andic soil properties, whichever is shallower, if there is no lithic or paralithic contact, duripan, or petrocalcic horizon within that depth; *or*

b. Between either the mineral soil surface, or the top of an organic layer with andic soil properties, whichever is shallower, and a lithic or paralithic contact, duripan, or petrocalcic horizon."

NSTH 615.60 p. 615-189 change item BGE. (Changed to CGE. in NSTH 615.91) to the following:

"CGE. Other Udands that have, undried, a 1500-kPa water retention of 100 percent or more, on the weighted average, throughout *either*:

1. One or more layers with a total thickness of 35 cm between the mineral soil surface, or of the top of an organic layer with andic soil properties, whichever is shallower, and 100 cm from the mineral soil surface, or of the top of an organic layer with andic soil properties, whichever is shallower, if there is no lithic or paralithic contact, duripan, or petrocalcic horizon within that depth; *or*

2. 60 percent or more of the thickness between either the mineral soil surface, or the top of an organic layer with andic soil properties, whichever is shallower, and a lithic or paralithic contact, duripan, or petrocalcic horizon.

Hydrudands"

NSTH 615.60 p. 615-194 definition of Hydrudands change item 4. to the following:

"4. Have, undried, a 1500-kPa water retention of 100 percent or more, on the weighted average, throughout *either*:

a. One or more layers with a total thickness of 35 cm between the mineral soil surface, or of the top of an organic layer with andic soil properties, whichever is shallower, and 100 cm from the mineral soil surface, or of the top of an organic layer with andic soil properties, whichever is shallower, if there is no lithic or

paralithic contact, duripan, or petrocalcic horizon within that depth; *or*

b. 60 percent or more of the thickness between either the mineral soil surface, or the top of an organic layer with andic soil properties, whichever is shallower, and a lithic or paralithic contact, duripan, or petrocalcic horizon."

NSTH 615.60 p. 615-200 Definition of Vitrands, change item 4. to the following:

"4. Have a 1500-kPa water retention of less than 15 percent on air-dried samples *and* of less than 30 percent on undried samples, throughout 60 percent or more of the thickness *either*:

a. Within 60 cm either of the mineral soil surface, or of the top of an organic layer with andic soil properties, whichever is shallower, if there is no lithic or paralithic contact, duripan, or petrocalcic horizon within that depth; *or*

b. Between either the mineral soil surface, or the top of an organic layer with andic soil properties, whichever is shallower, and a lithic or paralithic contact, duripan, or petrocalcic horizon."

NSTH 615.62 p. 615-320 Move item HEBD. to follow item HEBA. and change the number to HEBB. and renumber the items HEBB. and HEBC. to HEBC. and HEBD.: